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Devoted to Entomology in General.

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JOURNAL

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New York Entomological Society.

Vol. V. MARCH, 1897. No. 1.

LIFE-HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—VII–IX.

By Harrison G. Dyar, A.M., Ph.D.

PLATES I-II.

Tortricidia fasciola *Herrich-Schæffer.*

1854—*Limacodes fasciola* Herrich-Schæffer, Ausser. Schmett. fig. 186.
1860—*Limacodes laticlavia* Clemens, Proc. Acad. Nat. Sci. Phil. XII, 157.
1864—*Lithacodes fasciola* Packard, Proc. Ent. Soc. Phil. III, 345.
1882—*Limacodes fasciola* Grote, Check List, 17.
1886—*Lithacodes laticlavia* Hy. Edwards, Ent. Amer. II, 9.
1891—*Limacodes fasciata* Smith, List Lep. 28.
1892—*Lithacodes fasciola* Kirby, Cat. Lep. Het. I, 555.
1894—*Tortricidia fasciola* Neumoegen & Dyar, Journ. N. Y. Ent. Soc. II, 76.

Larva.

1860—Clemens, Proc. Acad. Nat Sci. Phil. XII, 157.
1872—Lintner, 26th Rept. N. Y. State Cab. Nat. Hist. 149.
1883—Saunders, Ins. Inj. Forest Trees, 179.
1893—Packard, Proc. Am. Phil. Soc. XXXI, 101.
1894—Dyar, Ann. N. Y. Acad. Sci. VIII, 221.

Special Structural Characters.

Dorsal space broad, flat, narrowing to the ends in a short rounded margin, gently arched; lateral space broad, oblique, slightly concave, narrowing to the ends; subventral space small, retracted. Subdorsal ridge slight, angulated, smooth at maturity, the tubercles disappearing during ontogeny and finally the setæ also. Lateral ridge moderately prominent, also smooth at maturity. Head and joint 2 well retracted. Segments unusually distinct, the incisures marked, cleft-like. Dorsal outline elliptical, joint 13 forming a broad quadrate termination. Depressed spaces (1) to (8) present, deep, but not large, the margins

rounded, not sharply defined; (4) is evidently situated in the incisure on the posterior edge of its corresponding segment. (1) and (4) are the largest and have distinct dark centers, both transversely elongated. Skin granules large, rounded, contiguous, rather confused and irregular so that the surface appears creased and coarsely shagreened rather than covered with distinct granules. In stage I the setæ are arranged as in *Apoda y-inversa* and have the same structure. Their course of reduction in the later stages is also the same. The skin granules when first appearing are of two forms, numerous fine ones and a few larger ones which form short spines on the ridges. These persist till the last stage, when the granulation is rendered uniform, but confused.

The coloration is a light yellowish green, marked obscurely with yellow, adapted to the color of the leaves it feeds on.

AFFINITIES, HABITS, ETC.

This larva is nearly allied to *Apoda y-inversa* and to what I now think is *A. biguttata*, * also in a less degree to the Packardias. It differs from these in the peculiar granulation. In referring the species to *Tortricidia*, the characters of the moth alone were considered. On the whole the species seems not strictly congeneric, phylogenetically, with either *Apoda* or *Tortricidia*, and the name *Lithacodes* would be justified, if any good characters could be found in the moth. From *Tortricidia pallida* and *Heterogenea flexuosa* (?) this larva differs in the slight development of the depressed spaces which are as in *Apoda*. The shape is similar in both.

T. fasciola ranges to the north, probably as far as *T. pallida* and it also ranges well to the south. It is an abundant species in New York, the larvæ always well separated and living on a variety of plants, for the most part low. Occasionally the larvæ will be found on very low shrubs. They are not particular as to the position of their food plant in regard to light, being found in open as well as dark woods. The small eggs are laid singly on the backs of the leaves in July and the larvæ mature in September. There are seven larval stages, occasionally eight, the larvæ feeding in stage I, as in all the smooth Eucleids. †

A newly hatched larva was found by me on wild cherry and carried through to maturity. I am indebted to Miss Morton for fertile eggs, from which also I followed out the life history.

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* Described as *Apoda y-inversa*, Ann. N. Y. Acad. Sci. VIII, 221.

† Our statement to the contrary in the case of *Apoda y-inversa* is an error.

CRITICISM OF PREVIOUS DESCRIPTIONS.

Dr. Packard's description is the only one of importance. His figure of Stage I is not drawn in a detailed manner, many of the setæ being omitted or incorrectly drawn. The description is like the figure, but is not corroborated by my observations. I think the setæ at the extremities were not carefully examined, and the spiracles have been put in in the wrong place. The lowest row of short setæ in the figure probably represents the subventral row, not shown in my figure (Plate I, Fig. 1) and the spiracles should be above it. Besides stage I, Dr. Packard describes the last three stages, V, VI and VII (marked III?, IV? and "last stage"). I find the descriptions excellent. The dorsal and lateral depressed spaces are quite fully described and located, though the upper segmental lateral (3) are said to be situated "on a suture"* which is not the case. I also object to the centers of the dorsal depressions (1) being called warts, and the broken yellow line along the lateral ridge being described in the same series as the lateral depressed spaces.†

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, narrower than usual, not greatly flattened, the upper surface arched; size .7 × .5 mm., height about .2 mm. and therefore unusually high in proportion. Reticulations obscure, irregularly hexagonal, linear. Color whitish translucent with a very faint yellow tint. They hatch in eight days.

Stage I. (Plate I, Fig. 1).—Head whitish, eye black, mouth brown. Body highest at joints 3–4, rather square. Setæ arranged as in *Apoda y-inversa* and with the same structure, colorless. Body all whitish, without marks. The subdorsal setæ on joints 5, 7, 9 and 11 lean out, alternating with the others; all have expanded cleft tips, the subdorsals on joints 4 to 12 with a short spur near the base. The lateral setæ on joint 5 leans upward more than the others. After eating, the blood becomes pale green and the dark alimentary canal shows by transparency. Length .7 to 1.1 mm.

Stage II.—Elliptical, tail squarish; dorsal space broad, lateral moderate, subventral small; ridges prominent, tubercular; two setæ on

* "On each of the lateral slopes of the plateau are four rows of lemon yellow spots, the highest and first being a row of minute transverse spots situated on the suture."

† "The *fourth row* is on the margin of the body, and is a broken series of short lines."

subdorsal ridge, one on lateral ridge of abdomen (Plate I, Fig. 4), a secondary setæ above the spiracle and the two of subventral row below it. Upper setæ long, stiff, black at apex. Skin with sparse granules produced into slender spines, longest and most numerous along the ridges at the bases of the setæ; a few distinct spines in the dorsal space, but in the lateral area mostly fine granulations only. Color translucent pale greenish, no pigment. Segments well marked. Length 1 to 1.6 mm.

Stage III.—Body moderately elongated, elliptical, more elongated than *T. pallida*. Skin very finely granular, frosted under a half-inch objective, which hardly resolves the fine granules; conical, clear, pointed tubercles, much larger than the granules, are distributed in a single row along the low, rounded latticed ridges, becoming pale secondary spines on the tubercles. Tubercles low and rounded, the subdorsal ones with two, lateral with one large, dark, stiff setæ. Ridges prominent, normal. Color pale green, alimentary canal dark. Toward the end of the stage a faint yellow line appears along the subdorsal ridge and yellow dots in the dorsal depressed spaces (1); all the depressed spaces faintly shown. Length 1.5 to 2.6 mm.

Stage IV.—Ridges well marked, tubercular, setæ black. Tail quadrate, composed of the last abdominal segment. Depressed spaces as in *T. pallida*, but ill defined, the separating latticed ridges obscure. Skin finely granular, the larger spinose granules few in number except on the ridges. Color light green, dorsum dark, translucent. A narrow yellow line below the subdorsal ridge, a series of yellowish dorsal rings in the depressed spaces (1), seven of them distinct; a row of lateral whitish spots (4). Length 2.5 to 4 mm.

Stage V.—Elliptical, tail quadrate, dorsal space moderate, lateral broad, oblique, subventral small, retracted. Ridges only slightly tubercular. Latticed ridges low, with both coarse and fine granules as before, the former becoming pale spines on the ridges, especially the lateral one (Plate I, Fig 5). Color yellowish green, a narrow, wavy, yellow, subdorsal line; yellow rings in depressed spaces (1), two yellow dashes in (4), separated by a green spot; the other depressions show as yellow dots. There may be a distinct dark green spot between spaces (1) and (2) in certain larvæ. Length 3.5 to 6.7 mm.

Stage VI.—(Plate I, Figs. 2 and 3.) Ridges slightly tubercular with distinct black setæ, but without secondary spines; shape elliptical, the tail quadrate as in the mature larva. Skin confused granular, the granules resulting from the two kinds of the former stage, alike now except in size, somewhat flattened in the dorsal space and irregular. Yellow-

ish green, a narrow, slightly wavy subdorsal yellow line, free at the ends; depressed spaces (1) to (6) yellow, (1) green centered, (4) bisected by green, (6) above the lateral ridge, nearly divided by the incisure; traces of a white subventral line and a broken yellow one on the lateral ridge. Length 5 to 7.7 mm.

Stage VII.—(Plate I, Fig. 6.) Smooth, the setæ absent; shape as described. Depressed spaces moderately developed, without sharp edges. Skin granules irregular, confused. Color yellowish green, dorsal space and upper half of lateral space pigmented, below more translucent. Subdorsal line yellow, narrow, waved by slightly darker green segmental dots above; lateral line broken, faint, all joining on joint 13, the subdorsals also on joint 3 anteriorly. Subventral edge white. Depressed spaces (1) to (6) pale yellow, (1) and (4) plainly green centered. Length 7 to 13 mm.

Food-plants observed.—Wild cherry, white birch, bayberry, dogwood, chestnut, sugar plum, oak, linden, maple, beech, hop hornbeam, hickory and huckleberry.

Adoneta spinuloides *Herrich-Schæffer.*

1854—*Limacodes spinuloides* Herrich-Schæffer, Ausser. Schmett. figs. 187, 188.
1860—*Adoneta voluta* Clemens, Proc. Acad. Nat. Sci. Phil. XII, 158.
1864—*Cyclopteryx leucosigma* Packard, Proc. Ent. Soc. Phil. III, 345.
1865—*Limacodes ferrigera* Walker, Cat. Brit. Mus. pt. XXXII, 486.
1882—*Adoneta spinuloides* and *leucosigma* Grote, Check List, 17.
1894—*Adoneta spinuloides* and *leucosigma* Neumoegen & Dyar, Journ. N. Y. Ent. Soc. II, 71.

LARVA.

1860—Clemens, Proc. Acad. Nat. Sci. XII, 158.
1882—Ballard, Papilio, II, 83.
1883—Edwards & Elliot, Papilio, III, 129.
1892—Beutenmüller, Bull. Am. Mus. Nat. His. IV, 68.
1893—Packard, Proc. Am. Phil. Soc. XXXI, 92.
1894—Dyar, Ann. N. Y. Acad. Sci. VIII, 213.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space moderately broad, narrowing to the ends, lateral and subventral spaces both moderate, subequal, the latter scarcely retracted. Body elongate, narrow, rising rather rapidly to joint 5, thence sloping to joint 13. Ridges all slight, subdorsal indicated by change in direction between back and sides, lateral very slight, the row of horns forming most of it. Horns short and small, rounded, the subdorsals on joint 3 to 5 and 11 the largest, those on 8 and 13 next, the rest all

quite small. Skin densely and coarsely covered with subconic clear granules, uniformly and without distinct depressed spaces, (1) indicated by paired white dots in a slight intersegmental furrow, (3) just indicated, whitish, (4) as faint pale rings. In the subventral space large rather indistinct hollows (7) alternate with the spiracles, forming perpendicular segmental ridges, reaching to the subventral edge. Caltropes are present in the last stage only, in little patches on top of the lateral horns on joints 6 to 11 and large patches on lateral of 12 and subdorsal of 13.

The first stage does not differ from that of *Euclea delphinii* and the mature larva, though differing in shape, is also adapted for concealment by its coloration. Its defensive armor is even more reduced than in the *Euclea* mentioned.

AFFINITIES, HABITS, ETC.

In the shortened horns the larva closely resembles *Euclea delphinii*. It is more generalized than this species since there are no detachable spines and the bright colors remain. It is more specialized than *E. indetermina* in the shortening of the horns and the alteration in shape, which resembles *Parasa chloris*, except in the absence of a tail. Our two Eucleas, the *Parasa* and *Adoneta*, form a closely allied group.

The eggs of *Adoneta* are laid in July and the larvæ mature in September as usual. The larva is a low feeder and, as several eggs are not infrequently laid at once, several larvæ are usually found on the same plant. The bright colors of the larva possibly have little warning effect as the spines are nearly functionless; but they may serve rather as in the smooth Eucleids to suggest patches on the leaves.

I am indebted to Miss Morton for the eggs of this species. She has also furnished the material for Dr. Packard's descriptions and thus our present knowledge of this life history is entirely dependent upon her.

CRITICISM OF PREVIOUS DESCRIPTIONS.

Though there are but few references to this larva, it may be said to be well known, owing to the early date of Clemens' writing and to Dr. Packard's very full and excellent account. In my description the lateral horns are located below the spiracles; the true position is given by Edwards & Elliot. Mrs. Ballard's "strap-shaped lines, buttoned at either end," are to be interpreted as transverse streaks between the paired dots of depressed spaces (1). Dr. Packard describes the "whole life history" in five stages. There are really seven, and Dr. Packard has doubtless been misled by a too hasty generalization from observations of the Notodontidæ. The stages which he gives seem to be I,

III,* IV, VI and VII, which illustrates the life history very well, though it is not a complete account of it, as it purports to be. The description and figure of stage I are in error in placing a lateral horn on joint 5. In stage "IV" (= VI) the paired glandular dots (1) are again called "warts," and in the last stage he says "these dots appear to be modified surface dorsal piliferous warts . . ." I do not think they are. The appearance is glandular and I have seen in *T. fasciola* a small drop of moisture in the location of each one of these depressed spaces which I believe was the secretion, not at the time evaporated. Besides, all the normal primary warts are situated elsewhere, and there are no warts, primary or secondary, in the whole order Lepidoptera in such a position (in the incisures). That they are not secondary warts is indicated by the fact that they are not more distinct in the early stages and never bear any setæ, as would be expected if they were degenerate warts.

Dr. Packard regards *Adoneta* as one of the more generalized forms of its group, and with this I agree, though I think it is not so generalized as *Euclea indetermina*. He says: "This larva indicates in some points of its structure its descent, and that of the group to which it belongs, from the Attacinæ; these points are the setiferous tubercles and the distinctness of the segments from one another, the sutures being well marked."

Recently Dr. Chapman also falls in with this view. He says (Trans. Ent. Soc. London, 1896, p. 584): "My observations on the spines of *Limacodes* and *Eacles*, and again of these and Sphinges and Saturnids . . . . and the observations of Poulton and Weissman, on the larvæ of *Aglia*, Sphingidæ, etc., leave no room for doubt that all these families are related . . . ." The question of the relation between the Sphingides and Saturniides, which Poulton, Weissman and Müller discuss, is aside from the present matter, and cannot be answered with the same certainty till some more generalized Sphingidæ are found. But the relationship which is claimed between the Eucleidæ and Saturniides on account of the spines, seems to me of exactly the same nature as that between the species of *Apatela* and the several families in which Mr. Butler once distributed them, based with equal probability on the similar structure of the hairs.†

* Mr. Bridgham is quoted as stating that this stage was drawn "after the first molt." However, I imagine that the true first molt escaped his observation, as I do not suppose he was looking for a molt before the larva had eaten anything.

† The stinging spines of the Saturnians (Hemileuca, etc.) are not ancestrial to the whole group, nor are they so in the Eucleidæ, which I expect to illustrate in a genealogical tree to be given at the end of these articles.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, flat, 1.1 × .7 mm., milky whitish when laid on glass, reticulations obscure. Laid singly or in patches of two to ten, slightly overlapping. They hatch in seven days.

Stage I.—(Plate I, Fig. 8) Structure as in Euclea; eleven horns in subdorsal row, nine in lateral row, the one on joint 5 absent. Three setæ on each horn, tapering, slightly enlarged and notched at the tips. Color uniform, translucent whitish; skin smooth; head white, eye black. Length .9 mm. The larva does not feed in this stage and molts in two days from the time of hatching.

Stage II.—Head white, eye black, mouth brown; horns spined, the long subdorsals, with a bunch of black-tipped spines, the short ones with one spine; lateral row moderately spined. Color opaque whitish; dorsal depressed spots (1) paired, greenish, two pair on the incisures 3-4 and 4-5, those on interspaces 8-9 and 9–10 connected into a transverse streak. No marks except a white line along the subdorsal ridge. Length, .9 to 2.2 mm.

Stage III.—Thickest through joints 4–5; dorsum flat, sides nearly perpendicular; lateral ridge moderate, shape as in the mature larva. Subdorsal horns on joints 3, 4, 5, 8, 11 and 12 large, rounded, not long, the others very small, but with several spines, lateral horns all small. Color whitish, dorsum and upper half of sides green from food; a white subdorsal line, thickened at the large horns, causing the dorsal space to widen and contract. In the wide spaces on joints 4–5 and 6–7 a rounded patch of pale purplish pigment, and in the space 9–10 a smaller whitish patch. Skin finely clear granular except on the horns. Dorsal dots (1) white. Later all the dorsal patches become purple-red and there is another on joints 3–4; subdorsal horns faintly yellowish. Length, 2.1 to 3.3 mm.

Stage IV.—Structure as in the mature larva. Skin clear granular, the paired white dots (1) visible where the ground color is purple. Markings at first as at the end of the last stage; later the subdorsal horns on joints 3 to 5 are tipped with red; a yellow line on subdorsal ridge, bent up at the large horns, the dorsal space filled in with dark purple except in a space from joint 7 posteriorly to joint 9 anteriorly. Sides green, the lateral horns colorless. Length, 3.2 to 4.7. mm.

Stage V.—Horns as in *Euclea delphinii*, the spiracle on joint 5 moved up. Long horns on joints 3 to 5 and 12 red tipped, the short ones pale yellow, lateral ones colorless. Colors as before, the waved

purple patches extending on joints 3 to 7 and 9 to 12, separated by a green space. Spines with black tips, rather delicate; skin closely and finely clear granular. Depressed spaces (1) and (2) indicated as glandular dots, large lateral ones (4) as ill defined hollows, all obscure. Head greenish, eye black. Length, 4 to 6.5 mm.

Stage VI.—As before; patches dark reddish purple. Subdorsal horns on joint 6 and 7 moved outward a little, not in line with the others; that on 8 rather larger than the other short horns. A distinct green line edges the subdorsal band below. Dorsal purple band broken as before or continuous, incised at the large horns. Sometimes the subdorsal horns of 11 and 13 are red tipped as well as 3 to 5 and 12. The purple band is bordered with crimson; a pale dorsal line; no caltropes. Length 5.7 to 9 mm.

Stage VII.—(Plate I, Figs. 9, 10 and 11) Appearance as before, but there are caltrope patches (Plate I, Fig. 14) on top of the lateral horns of joints 6 to 12 and a large one on joint 13. Dorsum purple, darker at the edges, incised by yellow on joints 4, 5, 8, 11 and 12; a straight pale dorsal line and the glandular dots (1) whitish, two pairs on incisures 3–4 and 4–5, one pair in the other incisures. Addorsals (2) indicated as tiny pale dots, seen on joints 9 and 10. Long horns on 3, 4, 5, 8, 11, 12 and 13 red, the rest yellow, the largest .6 to .7 mm. long, the shortest rounded. Sides green, darker below both ridges, a broken whitish line along lateral ridge. Depressed spaces (4) show faintly and an ill defined hollow between the segments subventrally (7). Skin with low conic clear granules (Plate I, Fig. 12); spines small, black tipped (Plate I, Fig. 13). Length 8.2 to 11.8 mm.

Besides this, the usual form, examples occur with more red, or with less.

Form A.—Normal; no red except the subdorsals of 3 to 5, 8, 11 and 12, and the lateral of 3. Sides green, a broken yellow line on lateral ridge.

Form B.—Subdorsal horns 3 to 13 and lateral 3 all red; some yellow shading in the lateral space, the lateral line nearly continuous.

Form C.—Horns red and a vermilion stripe connecting their bases on joints 3 to 12; purple marks with a crimson edge and a blurred, irregular, crimson band in the lateral space, shading into the subdorsal red anteriorly; below it a yellowish or whitish shading.

Form D.—Subdorsal horns on 3 reddish, all the rest yellow; dorsal purple band pale, edged with green inside the yellow line, divided by yellow on joints 8, 11 and 12.

Food-plants observed.—Willow, oak, wild cherry, bayberry, linden, witch-hazel, chestnut, beech and sour-gum (*Nyssa*).

EXPLANATION OF PLATE I.

Tortricidia fasciola.

Fig. 1. Larva in stage I, side view, enlarged.
" 2. Larva in stage VI, side view, enlarged.
" 3. The same, front view.
" 4. One segment, stage VI, showing setæ.
" 5. Skin granules at one of the setæ of lateral row.
" 6. Mature larva, enlarged, dorsal view.
" 7. Moth of *T. fasciola.*

Adoneta spinuloides.

" 8. Larva in stage I, side view, enlarged.
" 9. Mature larva, side view, enlarged.
" 10. The same, front view.
" 11. The same, back view.
" 12. One of the short horns of subdorsal row and adjacent skin granules.
" 13. A single spine, enlarged.
" 14. Caltropes from a lateral horn.
" 15. Moth of *A. spinuloides.*

Euclea indetermina *Boisduval.*

1864—*Callochlora vernata* Packard, Proc. Ent. Soc. Phil. III, 339.
1882—*Parasa chloris* Grote, Check List, 17.
1891—*Parasa viridus* Dyar, Trans. Am. Ent. Soc. XVIII, 154.
1891—*Parasa viridus* Smith, List Lep. 28.
1893—*Euclea indetermina* Dyar & Doll, Ent. News, IV, 311.
1894—*Euclea indetermina* Neumoegen & Dyar, Journ. N. Y. Ent. Soc. II, 68.

LARVA.

1797—Smith & Abbot, Lep. Ins. Ga., pl. 73.
1832—Boisduval, Cuvier's An. Kingd. (Griffith), Pl. 103, Fig. 8.
1852—Harris, Ins. Inj. Veg. 323.
1858—Duncan, Nat. Libr. XX, Pl. 21.
1878—Andrews, Psyche, II, 271 (as *Parasa chloris*).
1885—Edwards & Elliot, Papilio, III, 128.
1885—French, Can. Ent. XVII, 161.
1893—Dyar & Doll, Ent. News, IV, 311.
1894—Dyar, An. N. Y. Acad. Sci, VIII, 214.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space broad, narrowing only slightly at the ends, curving down anteriorly and posteriorly at joints 3–5 and 11–13. Sides nearly

perpendicular, the lateral and subventral areas practically continuous, the latter not retracted, spiracles exposed. Elongate, subcylindrical, the subdorsal ridge marking the change in direction of back and sides; lateral ridge slight. Horns well developed, irregular, well armed with strongly stinging spines. Subdorsals on joints 3 to 5, 8, 11 and 12 long, those on 5, 8, 11 and 12 longest, 6, 7, 9 and 10 very short; lateral horns moderate, those on joints 3 and 4 longest, that on 5 absent. Depressed spaces feebly developed, (1) to (4) (7) and (8) indicated by obscure dark, impressed dots, (1) paired. Skin densely finely spinulose-granular, the granules colorless. Patches of caltropes are present on the lateral horns of joints 6 to 13 and subdorsal horn of 13, but no detachable spines. The larva is very brightly colored. In the first stage the horns have the structure and arrangement of *E. delphinii*, three setæ from the apex of each.

This larva stands near *Sibine stimulea* in degrees of specialization. Its skin structure is higher, but the detachable spines are absent and the coloration is less diversified. It is, therefore, on the whole, a little lower than Sibine. It stands, perhaps, nearest the main stem of the spined Eucleids of any of our species. The horns at maturity are scarcely modified in relative proportions from the condition in stage I; the primitive bright warning colors are present and the urticating spines are in full functional activity, neither as yet affected by degeneration. The shape is more like that of an ordinary lepidopterous larva than usual. Therefore, we may regard *E. indetermina* as, on the whole, most like the ancestor of the spined Eucleids of any New York species, exclusive of *Phobetron pithecium*, which represents a still older condition.

AFFINITIES, HABITS, ETC.

This species is a typical representative of the group of spined Eucleids. Its near allies are found throughout South America and in India. Our nearest species is *Euclea delphinii*. The moth, however, so closely resembles that of *Parasa chloris* that the two species were for a long time confounded. They were separated by Grote in 1881, but Herrich-Schaeffer's figure was not correctly identified. It was suggested by Andrews, from the structure of the larva, that the species should be placed in *Euclea* rather than in *Parasa*, and this opinion is confirmed by the venation of the moth.

E. indetermina has a southern range. It occurs around New York City, but seems to be entirely absent from the Hudson valley. It is rather local in its appearance, often being common in certain localities

and absent in others near by. Though not gregarious many are often found on the same bush. They are low feeders, not occurring on trees to any extent.

The eggs are laid during July and the larvæ mature toward the middle of September. They remain on the under sides of the leaves in spite of their very conspicuous coloration. The effect of a touch of their spines is about the same as that of *Sibine stimulea*. The larvæ have eight stages, occasionally nine. Two examples bred from eggs of the same moth varied in this respect. They do not feed in stage I, which is rapidly passed through.

I am indebted to Miss Morton for obtaining for me the eggs from moths bred from larvæ part of which I collected and part obtained from Mr. Doll.

CRITICISM OF PREVIOUS DESCRIPTIONS.

All of the references given are to figures or descriptions of the mature larva, none of them going into structural details. The two best are that of Professor French (1885) and my own (1894). I notice nothing important of a positive nature to criticize except that in Prof. French's account the segments from which the horns are said to arise are not quite accurately numbered.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Singly, or in small groups, slightly imbricated. Elliptical, flattened, translucent pale ocher yellow on glass, 1.5 x .9 mm.; reticulations obscure, visible only in a strong light, rounded hexagonal, nearly linear, somewhat irregular. No special characters. They hatch in nine days.

Stage I.—(Plate II, Fig. 1.) Not different in structure from *Euclea delphinii*, the horns proportioned the same, each with three setæ with slightly swollen tips. Color rather dark yellow, shining, the long horns whitish. Segments well marked; skin smooth. Shape as usual, elongate, squarish, the horns low conical, prominent, their bases contiguous. Length 1.1 mm. The larvæ do not feed in this stage.

Stage II.—Subdorsal horns on joints 3, 4, 5, 8, 11 and 12 large, rounded; the rest small, all furnished with stinging spines; the short subdorsals (joints 6, 7, 9, 10) bear only one spine and are crowded up adjacent to the next large horn. Spines pale, black tipped. Ridges whitish, but dorsal and lateral spaces faintly shaded with dull red; horns pale. Dorsal depressed spaces (1) cleft-like with paired dots. In shape the larva is thickest through joints 4–5, the outline elliptical;

dorsum flat, sides nearly perpendicular, composed of both lateral and subventral spaces. During the stage the color changes. Dark brown, the subdorsal horns pale yellow, only the long ones visible. Subventral space very narrow, the bulging subventral edge colorless. Length 1.1 to 1.8 mm.

Stage III.—Upper side dark velvety brownish red as far as the upper edge of the lateral horns; subdorsal horns on joints 3, 4, 5, 8, 11 and 12 large, thick, light yellow, the short horns not showing; lateral horns all small and with the subventral space light yellow. Skin obscurely finely granular. Dorsal pale dots paired, very faint. The short subdorsal horns have one spine only. Length 1.8 to 3 mm.

Stage IV.—(Plate II, Fig. 2.) As before. Color velvety red-brown, the long horns and subventral region pale yellow; a white line along subventral edge. Later the long horns become orange at the tips and a straight white line appears along the middle of the sides between the subdorsal and lateral horns, broken segmentally. Body high, sides nearly perpendicular, horns erect. The short subdorsals have two or three spines and are situated as before adjacent to the long ones. Length 3 to 4 5 mm.

Stage V.—The six pairs of long horns prominent, thick, alike and well spined; bright red; the four short ones small, rounded, inconspicuous, yet reddish. A faint pinkish dorsal line and traces of one along the subdorsal ridge, ill defined on the dark purple ground which reaches to the lateral horns. Lateral horns faintly pinkish. Subventral region colorless, white on the lower edge. Later in the stage all the horns are fine red and three pale lines can be seen, an addorsal pair besides the dorsal, these new lines faint and broken by the large horns. Also three pale lines in the lateral space, one above and one below the original lateral line. Length 4.5 to 7 mm.

Stage VI.—Horns short at first and pale, but they quickly grow. Color all purple brown, the horns red. Dorsum with three bluish white lines, the outer ones waved and indistinct, lateral space with three yellowish white lines, only the middle one distinct; subventral space with two white lines; obscure red lines along the two rows of horns. Skin finely clear granular. Later the broad lateral pale line and subventral edge may be tinged with red. Length 7 to 10.5 mm.

Stage VII.—The purplish black ground is now so much narrowed that it appears rather as dark lines on a pale ground. Dorsal space contracted at joints 3, 4, 5, 8, 11 and 12, traversed by three bluish white and four purple lines, somewhat broken. Subdorsal ridge whitish

above, broadly red centrally, the horns bright red. Sides blackish purple, a broad lateral line and the subventral edge red; a narrow whitish line above and below the lateral red line, the upper broken. A broad pale stigmatal line. Lateral horns red. Spines pale with black tips; skin clear granular. Small patches of caltropes are present on the tips of the lateral horns on joints 6 to 12 in eight stage larvæ. Length, 10.5 to 16 mm.

Stage VIII.—(Plate II, Fig. 3) Shape as described. The blackish lines are now still narrower and appear plainly as lines. Dorsal space bluish white with four black lines, waved and confluent opposite the large horns. The rest of the ground color pale yellow, the horns fiery red. Red bands along subdorsal and lateral ridges, in the middle of lateral space and along subventral edge. Sides with four black lines, subconfluent in pairs; subventral area with two black lines. Joint 2 purplish; venter honey brown. The red side-band is partly cut by the pale, dark centered, depressed spaces (4); spaces (1) small, paired, dark. Skin clear granular (Plate II, Figs. 4 and 6). Caltrope patches (Plate II, Fig. 10) present on the lateral horns of joints 6 to 12 and the subdorsal of joint 13. Spines enlarged at base, pale with black tips (Plate II, Fig. 8). Length, 16 to 22 mm.

In the yellow form all the red markings are bright yellow. It did not come under observation in the early stages, but doubtless differs from this only in the absence of red, beginning with stage IV. The yellow form seems the more generalized of the two.

Food-plants.—The larvæ feed on various kinds of low brush. I have notes of finding them on wild cherry, oak, hickory and bayberry.

EXPLANATION OF PLATE II.

Fig. 1. Larva in stage I, side view, enlarged.
" 2. Larva end of stage IV, dorsal view, enlarged.
" 3. Full grown larva, enlarged.
" 4. Skin granules from the region of the subventral ridge × 50, showing setæ iii and iv.
" 5. Base of same seta × 175.
" 6. Skin granules from region of subdorsal ridge × 175.
" 7. Abnormal skin granules from region of joint 2 × 175.
" 8. End of one of the large horns × 50, showing the wrinkled skin and spines.
" 9. Tip of a stinging spine × 175.
" 10. Caltropes in position × 175.
" 11. Moth of *Euclea indeterminata.*

THE IMMATURE STAGES OF DIABROTICA SOROR.

By R. W. DOANE.

[Mr. R. W. Doane, a student of entomology in this University (Stanford), undertook during the college year 1895–96 the study of the life-history of *Diabrotica soror*, the Pacific Coast representative of the destructive Diabroticas. Despite the abundance of *soror*, its serious ravages on flowers and fruits, and a lively interest on the part of entomologists in its habits, its life history has remained unknown. By reason of Mr. Doane's removal, his work, well begun and successfully prosecuted as far as carried, has been interupted. The following descriptions of the egg, larva and pupa, together with a few notes on the habits of the species, are extracted from his notes.—VERNON L. KELLOGG, Stanford University, California.]

The following descriptions were made from a number of specimens taken in the field and laboratory.

Egg.—Length, .7 mm.; width, 5 mm.; oval, dirty white in color; surface finely sculptured by minute hexagonal pitted areas. These areas under a higher power lens show several irregular depressions within their own surface.

Full-grown larva.—Length, 12 mm.; width, 1.3 mm.; body cylindrical, slightly tapering toward the head; the twelve segments behind the head indistinctly separated. General color, except the head, dorsal shield and last abdominal segment, dirty white, often becoming more yellowish before pupation. Head dark brown above and on the sides, same color as rest of body below; posterior margin with a deep, quite broad, V-shaped incision, ending in a broad deep suture which runs cephalad for nearly one-third the length of the head, then divides into two well-marked sutures which extend to the base of the antennae. These sutures divide the head into three distinct parts, the anterior part being the largest, the other two parts are equal and constitute the posterior and part of the lateral portions of the head. There is a dark median line ending at the tip of a small V-shaped incision in the anterior margin of the head, and a few rather strong hairs scattered over the surface of the head. Antennæ white, three-jointed; first joint a little broader than its length, second joint the shortest, narrower than the first, third joint cone-shaped, its greatest width about equal to its length. No eyes. Labrum same color as rest of the head. Mandibles dark brown, darker at tips, other mouth parts and appendages whitish.

Cervical shield brown, paler than the head, broadly shield-shaped with quite a broad median white line, a few rather long hairs and several shorter ones scattered over the surface. The remainder of the prothorax, the meso- and meta-thorax same color as the rest of the body. Legs pale, three-jointed, supported by dark brown chitinous framework; several short rather stout hairs on each segment; a whitish, elliptical, striated lobe arising beside the single brown tarsal claw. Segments four to eleven, all similar, skin wrinkled, somewhat papillose, a few scattering hairs over each segment; on the lateral margin of each segment is a long stiff hair just posterior to one and sometimes two smaller and shorter hairs. Dorsal shield of posterior segment semicircular in outline, dark brown, finely sculptured so as to produce numerous hexagonal pitted areas much resembling the markings on the eggs; several strong marginal hairs and two sub-triangular processes near the posterior end. A single fleshy proleg.

The larva agrees almost perfectly with Prof. H. Garman's description of the larva of *D. 12-punctata* as given in Psyche, Vol. VI, p. 48. The only special difference I would note is in the description of the dorsal shield of the posterior segment which he describes as follows: "Dorsal shield of posterior body segment nearly circular in outline, brown, with numerous minute black specks, slightly rimmed at posterior margin, and in young examples obscurely bituberculate; furnished with several strong marginal hairs, and with four minute, striate, centrally-placed spatulate appendages."

Pupa.—Whitish or straw-colored. Length .4 mm., width .2 mm. Scattered brown hairs over the body arranged as follows: six on the head arranged in three transverse pairs, one pair close to the base and just cephalad of the antennæ, one just caudad of the antennæ, and one near the meso-dorsal angle of the eyes; ten on the prothorax, one pair on the anterior margin, one pair near the lateral margin, and one pair near the posterior margin, a pair just anterior and a larger pair just posterior to the middle near the mesal line; an arched row of four hairs each on the meso- and meta-thorax; a pair in the middle and one on each side of each abdominal segment; last three segments with another pair slightly anterior to and more widely separated than the median pair; last segment also with a pair between and a pair in the bases of the caudal spines, and another pair just anterior to the lateral pair. Caudal spines usually slightly curved, brownish at tips. Each femur with three hairs near the extremity. Wing pads clear white, covering the proximal part of the posterior femor. Antennæ curving outward

around the femora of the meso- and meta-thoracic legs, then meeting on the median ventral line between them.

As the pupa grows older the eyes, wing parts, parts of the legs and antennæ and the tips of the mandibles begin to turn much darker.

Soror is especially injurious to the interests of the flower-grower. The beetles eat unsightly holes in the buds and petals of roses and chrysanthemums, and other showy flowers. It feeds on leaves too, and is almost unrestricted in range of food-plants. Fruit-growers often suffer serious loss by the beetle's eating the young forming fruit. The apricot seems especially the object of attack. Hardly any kind of garden vegetable is free from its attention.

The eggs are deposited, in breeding jars or out of doors, from ¼ to ½ an inch below the surface of the ground, near the base of some plant, sometimes singly but usually in numbers of from 20 to 50. The eggs hatched in the breeding jars in about eighteen days. The larvæ developed slowly. Larvæ of various sizes, some full grown, some newly hatched, were found around the roots of different plants out of doors in March, April and May. The larvæ do not bore into the roots, as *longicornis* and *12-punctata* do, but eat the roots from the outside, sometimes cutting the young rootlets entirely in two. The larvæ were found in abundance feeding on the roots of sweet-peas and alfalfa, and sparingly on other plants.

As the larva becomes full-grown it approaches the surface of the ground and forms an oval or spherical cell in which it lies ten or twelve days, semi-quiescent, before pupation. The pupal stage lasts from ten to fourteen days. The first out-of-doors pupæ were found early in April.

No special opportunity of combatting the pest is offered by its immature stages. The wide range of food-plants of larva and adult, and the underground life of the immature stages, make it a particularly difficult insect to fight.

NOTE ON CATOCALA ELDA *Behr.*

BY WM. BEUTENMULLER.

This insect was described as a distinct species from a specimen taken in Oregon. Since then three examples have been taken in British Columbia, and last summer Mr. Doll raised a single specimen from a larva found on Long Island, N. Y. It is, without doubt, nothing more than a gray variety of *C. relicta.* Mr. Palm already called attention to this fact. (Journ. N. Y. Ent. Soc., I, p. 21.)

ON THE LARVÆ OF CERTAIN SAW-FLIES (TENTHREDINIDÆ.)

BY HARRISON G. DYAR, PH. D.

Trichiosoma crassum *Kirby.*

Mr. MacGillivray has sorted out my bred material into two species of *Trichiosoma, T. triangulum* and *T. crassum.* There was no corresponding difference in the larvæ, however, and, therefore, that of *T. crassum* may be described as being indistinguishable from that of *T. triangulum.* (See Ent. News, vi, 199.)

Food-plants.—Willow, poplar, wild cherry and alder.

Hylotoma scapularis *Klug.*

The flies mentioned in Can. Ent., xxvii, 344, under label 2B were pronounced by Mr. MacGillivray to be males of this species. The following is the present state of this confusing subject:

Larvæ head black or red.
  No paler subdorsal line.
    Tubercles distinctly black.
      Head red, body yellow; on birch ..... V.
      Head black, rarely reddish, body yellow; on wild cherry..... S.
    Tubercles blackish only, or pale in black rings.
      Head blue black, body yellow; on oak 2B
  A pale yellow subdorsal line.
    Head red or black, body greenish-yellow; on willow 2C
Head pale testaceous with vertical dark band.
  Body green, tubercles nearly all pale..... 2L

Here are five rather distinct types of larvæ. From V have been bred *H. pectoralis, H. scapularis* ♀ and *H. cæruleus* ♂; from S has been bred *H. mcleayi*; from 2B *H. scapularis* ♂; larvæ 2C were bred from eggs laid by a female *H. clavicornis;* 2L produces *H. mcleayi* ♂ and *H. virescens* (*clavicornis*) ♀.

Description of larvæ 2B. Four last stages observed with widths of head .8, 1.1, 1.8 and 2.5 mm. Head rounded, uniform blue-black, the sutures scarcely visible; small black setæ in front. Body cylindrical, subventral ridge prominent; thoracic feet large, pale yellowish brown, the large basal joint blue-black. Abdominal feet on joints 6 to 10 and 13 small, the last pair rudimentary, pale at tip, their bases dotted with black. Segments coarsely 3-annulated with nine large (.35 mm.) setiferous tubercles in an approximate square, the lower posterior one moved inward; another behind the spiracle; these tubercles are black-

ish or yellow, edged with black. Subventral ridges oblique, prominent, pale, but margined with black and bearing many setæ. Anal plate obscure, blackish. Between the setæ are numerous small black dots bearing still more minute setæ. A row of four ventral setiferous black spots on each segment anterior to the legs and six medio-ventral segmentary round orange spots posterior to the feet on joints 6 to 10. Forms a reticular cocoon of yellow silk.

Macrophya bilineata *MacGillivray.*

Head whitish, eye black, a large black patch on vertex, neat, almost pyriform. Body segments 7-annulated with minute black setæ on the second and fourth annulets. Body tapering a little posteriorly, straight or curled spirally, feet on joints 6 to 13. Whitish, translucent, not shining, appearing green from the food except subventrally; a faint black lateral shade bounding the apparently green area; a single small sooty black suranal spot. Tracheæ distinct; thoracic feet clear with brown tips. Width of head 1.8 mm.

Ultimate stage.—Annulate, slightly shining, all immaculate, waxy, whitish emerald green. Head slightly testaceous, eye black, no marks. Enters the ground.

Food-plants.—*Viburnum opulus* and *V. cassinoides.*

Macrophya mixta *MacGillivray.*

Head reddish on vertex, eye black, no marks; width 1.8 mm. Body waxy greenish, 7-annulate, no marks. Another example had a dusky lateral shade defining the dorsal color which appears darker than the subventral region on account of the food showing by transparency. Ultimate stage like the preceding species.

Food-plant.—*Viburnum opulus.*

These two species of *Macrophya* occurred together and only one example of each was bred. I suspect that they are not specifically distinct.

Tenthredo remota *MacGillivray.*

Resembles *T. cressoni*, but less yellowish green, the skin being colorless and only green from the food; no subdorsal band of fat, at most only a few scattered granules. Widths of head observed .6, .8, 1.4, 1.8, 2.2 mm.

The egg forms a regular elliptical swelling near the middle of a leaf, 2 x 1.5 mm., under the lower epidermis, the saw-cut on the upper side.

Larva.—Head large, prominent, with grooves before the vertices

of the lobes; pale below, orange above, shining, eye black, no marks. Joint 2 small, the body only slightly tapering; feet on joints 6 to 13. Whitish translucent, not shining, food green the whole length, plainly visible. Thorax scarcely enlarged; segments finely and neatly 7-annulate, the incisures more distinct, slightly folded. Under a lens white points are present on the second and fourth annulets. No marks; thoracic feet colorless. Tracheal line not very distinct.

Ultimate stage.—Head shining whitish testaceous, eye black; body shining, pale clear honey yellow, rather whitish, somewhat opaque, neatly annulate; no marks.

Food-plant.—Yellow birch.

Taxonus dubitatus *Norton.*

Stage before last.—Head pale yellowish, a trace of brownish from minute dottings; a very small brown dot in apex of clypeus and behind eye, eye in a black spot. Body sordid waxy, green from food, anal end dark; segments 7-annulate, first and second annulets largest. No marks except the small black spiracles, antennæ, palpi, jaws and claws of thoracic feet.

Last stage.—Head pale brownish, a big black patch behind the eye. Body without marks except a large black subdorsal patch on joint 13 anterior to the anal flap; green from food, faintly yellowish, paler subventrally. Others have more spots on the head.

Food-plant.—*Onoclea*, sp. Occurred around New York City.

Taxonus albidopictus *Norton.*

Head shining pale brownish, a large triangular black patch on the vertex connects with a like one on the clypeus; another patch at its apex on the black eye reaching back to the occiput; these three patches have diffuse edges and the vertical and lateral ones are connected by a dark cloud; mouth brown; width 1.2 mm. Feet on joints 6 to 13; segments 7-annulate, rather unequal, annulet 2 large; slightly shining, smooth; dorsum to spiracles dark green, under the lens obscurely longitudinally streaked and divided by the pale dorsal vessel, especially on the thorax; on joint 13 a large round smoky black lateral patch; joint 2 anteriorly, subventral region and feet translucent whitish, thoracic feet black marked; spiracles black, tracheal line white. Bored in wood. Found on *Onoclea sensibilis* at Rouse's Point, N. Y.

Mr. MacGillivray remarks "this differs from the description (of Norton) in having more of black on the base of the abdomen and in having the apex of the posterior femora whitish. Judging from Pro-

vancher's description it is undoubtedly *albidopictus*." The larvæ of these two species of *Taxonus* cannot be certainly distinguished.

Harpiphorus tarsatus *Say*.

Eggs.—Laid under the lower epidermis, sawed through from above; close to the midrib in a long line, the cuts united; one edge of the swelling is on the midrib or large vein, the other parallel to it but wavy, composed of the numerous saw cuts; width 1 mm.; length 4 to 30 mm., according to the number of eggs laid; punctures .8 mm. apart.

Stage I.—Nearly colorless, head with a smoky tint especially in a shade upward from the black eye; width .5 mm.

Stage II.—Head brownish, a shade upward from the black eye; width .6 mm. Body all subtranslucent white, no marks; food green in thorax, more yellowish posteriorly; segments finely annulate. Body shape much as in the mature form; length 4.5 mm.

Stage III.—Head dark blackish brown, eye black; width .8 mm. Body without marks.

Stage IV.—Head brownish, a darker shade on the outer sides of the lobes; width 1.0 mm. Body whitish, the food green, anal plate brownish, feet colorless.

Stage V.—Head shining black; width 1.2 mm. Joint 2 anteriorly, subventral region and feet pale yellow; dorsum sordid pale olivaceous without marks, slightly shining; annulations obscure; anal plate dark. Length 12 mm.

Stage VI.—Head shining black; width 1.6 mm. Joint 2 and subventral region pale yellow; dorsum with a blackish rectangle on each segment on a whitish ground, the rest of the dorsum colored nearly like the sides. Later the coloration is more like the next stage.

Stage VII.—Like the next stage, but the marks a little fainter; with of head 2 mm.

Stage VIII.—Head small in proportion, lower than joint 2, all black, slightly shining, width 2.5 mm. Joint 2 anteriorly, subventral region, venter and feet orange yellow; dorsum to spiracles olivaceous black, annulet 2 in the middle and whole of annulet 4 to the subventral color pale greenish gray, both interrupted by the olivaceous dorsal vessel. Segments 6-annulate, the second and fourth with minute setæ. Anal plate black, darker than the dorsal marks. Thoracic feet spreading, pale yellow, not very large; abdominal feet all well developed. Body large at joint 2, gradually tapering posteriorly, rapidly at the end of joint 13. Length about 25 mm., width 4 mm. The pale dorsal bands

contain fat granules. In some examples they are broad and the dark markings diffuse and pale. No bloom or white down.

Stage IX.—(Ultimate.) Exactly as in the last stage except that the dorsal pale annulets are light blue instead of greenish gray, the black is bluish rather than olivaceous and the skin is very slightly more shiny. Head 2.5 mm. The larvæ bore in wood to pupate.

Food-plant—Dogwood (*Cornus alternifolia*).

Harpiphorus varianus *Norton.*

Described by me (Can. Ent., xxvii, 196) as *H. tarsatus*. The flies of these two species are occasionally alike in color, as Mr. Harrington indicates, but Mr. MacGillivray has separated them by the structure of the female saw-guide and saw. The larvæ are abundantly distinct.

Harpiphorus versicolor *Norton.*

Eggs.—About three laid side by side under the lower epidermis from above; a short row nearly parallel to a side vein; 1.5 × .6 mm., swelling the leaf; faintly yellowish with a green central area.

Stage I.—Head pale brown, eye black; width .33 mm. Body curled, whitish, rather opaque, without bloom. Food green in the slightly enlarged thorax.

Stage II.—Head pale brownish, darker over the vertex; width .5 mm. Body annulate, colorless or greenish from food, mealy white.

Stage III.—Head black, mealy only in a band across between the eyes; width .8 mm. Body yellow, well covered with the white mealy secretion.

Stage IV.—The same. Width of head 1.1 mm.

Stage V.—Width of head 1.5 mm.

Stage VI.—Head black, slightly mealy except the eye and mouth; width 2.1 mm. Body coarsely 6-annulate, mealy or short woolly to and including the subventral folds; no marks whatever; feet on joints 6 to 13. Thorax slightly enlarged.

Differs at once from *H. varianus*, in being without the black anal plate.

Stage VII.—(Ultimate.) Head black, yellow below the eyes, no bloom; width 1.5 or 2.1 mm. Body shining, the subventral folds and venter ocher yellow, dorsum blue gray, marked with leaden black on annulets 1, 3, 5 and 6 subdorsally and on all the annulets laterally, leaving a dorsal and a subdorsal line of the ground color connected on annulets 2 and 4. The lower end of this dorsal color is incised before the spiracle by the upper yellow subventral fold. Feet all pale; bores in wood. Found on *Cornus* at Greenwood Lake, N. J.

The following species have been named by Mr. C. L. Marlatt:

Schizocerus prunivorus *Marlatt.*

Egg.—In a pyriform slit under the lower epidermis at the middle of one edge of the leaf; laid singly. The larva hatches and eats a curious winding slit down into the leaf; later this reaches the edge.

Stage I.—Head pale greenish testaceous, eye black; width .4 mm. Body segments well marked, the incisures more perpendicular in front than behind, faintly 3-annulate. Translucent with a greenish tint; alimentary canal visible. Thoracic feet large, colorless with black shades at their bases; abdominal ones very small on joints, 6 to 11 and 13, colorless; joint 13 slightly bulging, with very small anal prongs.

Stage II.—The same; head green, width .6 mm.

Stage III.—Head .75 mm. All leaf green, blackish shades at the bases of the abdominal feet, eye black, mouth brown. Large suranal prongs green and a smaller more approximate subanal pair. Joint 13 a little enlarged. On joints 5 to 13 a series of small, colorless, eversible lateral glands. Abdominal feet rudimentary.

Stage IV.—Head 1.15 mm. All leaf green, a little brownish at the vertex, eye black. Body leaf green, shining, 3-annulate, food darker. Thoracic feet clear with a blackish cloud at base; abdominal ones rudimentary. Six anal prongs; a small pair at end of plate, a large lateral pair, reddish tinted and the small subanal pair. Lateral glands situated substigmatally, posterior. Subventral ridge distinct; tracheal line fine.

Stage V.—Head pale green, thickly brown dotted, eye black; width 1.4 mm. Body green, faintly 3-annulate, slightly blotched with yellowish subventrally; a black subventral shade on the thorax in spots at the bases of the feet which are green, clearer at tip. Subventral ridge fluted, glands small; the four suranal prongs brownish, subanal pair green. Tracheal line distinct; spiracles dark; no marks. Cocoon in the ground, reticular, of yellow silk.

Found on *Prunus pennsylvanica* and *Amelanchier canadensis* at Jefferson Highlands, N. H., and on *Prunus serotina* at Bellport, Long Island, N. Y.

Camponiscus americana *Marlatt.*

Head pale brown, shining, eye black; width 1.5 mm. Thorax enlarged, the feet spreading, pale; abdominal ones on joints 6 to 11 and 13. Segments indistinctly annulate, incisures well marked, folded. Whitish, not shining, the food makes the dorsum to spiracles green, the

posterior end of alimentary canal forms a blackish shade which looks like a mark at first glance. Thorax higher than head. Sits flat on the venter, usually curled spirally when at rest. Five stages were observed, but not consecutively.

Found on the poplar at Plattsburgh, N. Y., and at Jefferson Highlands, N. H.

Pontania populi *Marlatt.*

This is evidently what Mr. Marlatt had in mind when he said of the habits of the larvæ of *Pontania*, "at least one America species develops in the rolled or folded edge of the leaf."* The present species forms at first a small gall, but soon the leaf rolls over, gall and all, forming two or three turns and the larva lives in the tube so formed, without spinning any sort of web.

There are probably five larval stages. The larva remains in the gall up to as late as the fourth stage, but is usually out to feed in the third. It may be in the rolled part permanently in stage IV.

Gall.—A low irregular swelling on the upper side of the leaf, the nearest veins enlarged and tending to curve backward, rolling the leaf with the back side inward. Under side of gall thin, flat or irregularly rugose; above scarcely much thickened but folded up. Green or yellowish, an ill-defined swelling about 5 mm. in diameter, concealed in the rolled leaf.

Stage II.—(In gall.) Head pale brown, paler over the clypeus; body shining whitish; width of head .36 mm.

Stage III.—Head pale brown above clypeus; width .55 mm. Body annulate, shining, no marks; anal prongs dark.

Stage IV.—Head very pale brown; width .7 mm. Body colorless.

Stage V.—(In leaf.) Head all pale brown; width 1.0 mm. Body segments 3-annulate, whitish, scarcely shining, food green; two dusky brown corneous patches precede the dark tipped anal prongs.

The larvæ never eat the whole leaf, but the parenchyma only, even in the last stage. They spin small brown cocoons.

Found on *Populus grandidentata* at Fort Lee, N. J. There is more than one brood in the season, the larvæ infesting the successive leaves of young shoots.

Pontania terminalis *Marlatt.*

Allied to the preceding. Egg deposited under the lower epidermis forming a small gall-like swelling of the type of *P. populi*, but less pro-

* U. S. Dept. Agriculture, technical series, No. 3, 1896, p. 8.

nounced. A green elevation of the upper surface; below a thin skin, not swollen, but slightly yellowish; the leaf rolls over tightly in a close coil to two whole turns, finally as far as the midrib, from one half to the whole of one side of the leaf being involved. The little larva lives in the gall, but soon comes out of it and rests in the rolled part.

Stage II.—Head pale brownish, the eye black; width .3 mm. Body all whitish, food forming a narrow green line; slightly shining, annulated, thoracic feet of good size.

Stage III.—Head and anal flap shining black; width .4 mm. Body whitish, slightly shining, annulate.

Stage IV.—Head shining black; width .55 mm. Body shining, no distinct setæ, irregularly 4- to 5-annulate; feet on joints 6 to 11 and 13. Body whitish, slightly opaque, food green; the whole of anal flap black; anal prongs short, black.

Stage V.—Head pale in the sutures, a large black patch on each lobe and one in the clypeus; width .8 mm. Body 3-annulate, smooth, not shining, whitish with a slight yellow-green tint, food green; anal end concolorous, no patch at all, though the frass gives a dusky shade. Prongs very short, brown tipped. The larvæ eat the parenchyma only, as in the preceding species.

Found on willow at Van Cortlandt Park, New York City.

Pteronus dyari *Marlatt.*

I supposed this species to have been bred from the same larvæ which produced *Amauronematus luteotergum* (Trans. Am. Ent. Soc., xxii, 304), but Mr. Marlatt finds the flies distinct. Further observations are needed.

Pteronus hyalinus *Marlatt.*

I have described the larvæ as *Nematus lateralis* (Trans. Am. Ent. Soc., xxii, 307).

Pteronus lombardæ *Marlatt.*

Larvæ indistinguishable from those of *P. ventralis*, feeding on poplar instead of willow (Trans. Am. Ent. Soc., xxii, 305).

Pteronus populi *Marlatt.*

Indistinguishable from *P. hudsonii* Dyar in coloration in the last stage.

Egg.—In a cluster of saw cuts close together, but irregular, under the lower epidermis at the apex of a leaf.

Stage I.—Head .6 mm. Larvæ all blackish. Gregarious, eating holes in the leaf.

Stage II.—Head, calculated, .75 mm. All blackish.

Stage III.—Head 1.2 mm., shining black. Body black, immaculate at first; later, in some, faint yellow lateral spots as in *P. ventralis*.

Stage IV.—Head black, width 1.6 mm. Body greenish, tubercles and streaks on the annulets slaty black, not entirely confluent, leaving some of the green ground color especially dorsally and laterally; orange spots distinct; feet colorless.

The males spin at the end of this stage, or at least with this coloration and width of head.

Stage V.—Head 2.2 mm. Coloration as described for *P. hudsonii* (see Trans. Am. Ent. Soc., xxii, 306). Anal prongs short, black tipped.

Found on *Populus grandidentata* at Jefferson Highlands, N. H. Apparently the same larva also on willow at Greenwood Lake, N. J., and received from Mrs. Slosson from Franconia, N. H. There is more than one brood in the year.

Pteronus ostryæ *Marlatt.*

Head 1.6 mm, pale testaceous, a black patch at the vertex, eye black. Body all green, tar brown on the folds, annulate, not shining, no marks, no setæ.

This larva fell to the ground while I was examining a hop hornbean tree. It was ready to spin and I have not observed it feeding or in the appropriate coloration.

Amauronematus oregonensis *Marlatt.*

Whitish green, pilose, solitary on woolly willow at Keene Valley, N. Y., and Jefferson Highlands, N. H. It has just the appearance of the back of the leaf.

Whitish green, a white addorsal and stigmatal line, produced by the edges of the dorsal vessel and the tracheal line, supplemented by a few white granules under the skin laterally. Segments 3-annulate, with concolorous warts on each annulet, bearing short white pile. Feet on joints 6 to 11 and 13. Thoracic feet colorless outwardly, greenish at base. Head same color as body, eye and mouth black; width 1.2 to 1.4 mm.

Ultimate Stage.—Head shaded with pale blackish, eye black; width as before. Body greenish paraffin color, shaded with black on the three annulets except for a central subdorsal space on each, in a narrow dorsal line and in stigmatal spots, and spots on the subventral folds. No setæ, the dark spots representing the warts. Feet colorless.

Both now and in the previous stage (except for the hairs) very like the following species.

This or the following larva is described by Dr. Packard in the 5th Report, U. S. Entomological Commission as "unknown saw fly larva" on page 589, number 72 of willow insects.

Amauronematus similis *Marlatt.*

Straight, solitary on woolly willow at Plattsburgh and Keene Valley, N. Y., and Jefferson Highlands, N. H.

Abdominal feet on joints 6 to 11, very slight on 13. Head whitish, a little mottled with green, not shining; width 1.4 mm., eye and mouth black. Body a little flattened, subventral region rather prominent, the posterior segments slightly tapering. Color soft leaf-green, not yellowish, not shining; a distinct white subdorsal line, the pair approaching and nearly touching on joint 13; the line sends down a mottled white streak on all the annulets as far as the tracheal line, sometimes separated, forming a lateral line of streaks. A few obscure white dots ventrally. The white bands and streaks are composed of white granules below the skin. Feet pale, thoracic ones clear. Segments not very distinctly 6-annulate, no tubercles; spiracles minute, brown.

The larvæ feed resting on the edge of the leaf. In some examples there are small black dots on the thorax and subventrally on the abdomen.

Ultimate Stage.—Slightly shining, light green, translucent like ground glass, uniform. Segments 6-annulate, the second and third larger than the others. Dorsal vessel a shade darker, its sides showing faintly whitish; tracheal line narrow, thread-like.

Later the larva is shaded with blackish on all the annulets and the top of the head; bores in soft or decayed wood to pupate.

Amauronematus dyari *Marlatt.*

Larvæ described by me (Can. Ent., xxvi, 187) as *Nematus monochroma;* later determined by Mr. Marlatt as *N. brunneus* (Can. Ent., xxvii, 342). The final decision makes it a new species.

Amauronematus azaliæ *Marlatt.*

Solitary edge-eaters on *Azalea;* found at Jefferson, N. H., in June. The larvæ all disappear before the end of June, and there is only one brood in the year.

Head a pale green, finely brown-dotted except a narrow space bordering the brown clypeus; eye black; width 1.2 mm. Segments irre-

gularly and faintly 5-annulate; shining green, the dorsal vessel dark, the tracheal line evident; no marks except little dusky rings subventrally defining the obsolate tubercles, which can also just be distinguished dorsally with a lens, though perfectly concolorous. Anal prongs very short, remote, obscurely black-tipped. Setæ very fine and short. Thoracic feet clear with brown claws.

The larvæ became streaked with dusky blackish on the annulets, bringing out the tubercles more distinctly and entered the ground to spin.

Hemichroa laricis *Marlatt.*

Head pale brown, dotted, eye black; a pale arcuate line over the clypeus: width 1.4 mm. Body segments 5-annulate, the last two annulets folded; feet on joints 6 to 11 and 13. Body green, shaded with opaque pale green pigment subdorsally and broadly stigmatally, leaving more translucent dorsal and lateral straight lines and small irregular areas among the subventral folds. The bright green fat granules composing the pigment are aggregated along the dorsal vessel, tracheal line and subventrally. Feet concolorous, the thoracic clear with brown claws. Tracheal line straight, white. The larvæ are solitary and rest on a needle of the food plant with the head toward the twig. They are very difficult to distinguish in this position, since the brown head harmonizes with the bark and the green-striped body with the leaves. Found on the larch at Jefferson Highlands, N. H.

This larva is described by Dr. Packard in Fifth Report United States Entomological Commission as "*Selandria* (?) sp.," on page 901, number 26 of larch insects.

Pachynematus affinis *Marlatt.*

Feet on joints 6 to 11, none on joint 13. Body segments 6-annulate, the last two annulets small and folded, whitish. Tubercles on the second and fourth annulets. Head pale greenish with a bright testaceous tint by transparency, eye black, jaws brown; width 1.8 mm. Body pale green with a distinct, straight, rather broad white stigmatal line on joints 5 to 12, lost posteriorly in a whitish shade which covers joints 12 and 13; the edges of the dorsal vessel form a distinct white geminate line on joints 3 to 11, pulsating, lost in the white tint posteriorly. A blackish green subdorsal band on thorax, also on the abdomen, but of varying distinctness. Tubercles small, concolorous and obscure, setæ rudimentary, dark, situated in two transverse rows, on the second and fourth annulets, and thickly on the subventral folds. Abdominal feet green; thoracic clear with brown tips.

Swept from grass at Jefferson, N. H.; also on grass by Mr. L. H. Joutel at Greenwood Lake, N. J.

Pachynematus pubescens *Marlatt.*

Head round, shining, testaceous, eye black; width 1.3 mm. Body pale pinkish brown, a broad addorsal and stigmatal white band. The former borders the dorsal vessel and the pair are separated by the dark blood; the latter is edged above by a blackish shade. All the lines run from joint 2, but are lost on joint 13, the frass showing as a dark shade. Body slightly shining; segments indistinctly 5-annulate; feet concolorous.

Found on *Carex* near the summit of Mt. Washington by Mrs. Zella Dyar.

Pachynematus gregarious *Marlatt.*

Eggs.—Laid in an irregular group of slits under the lower epidermis toward the center of a leaf. The slits are close together and after the larvæ emerge remain as irregularly placed, lunate, hollow ridges, elliptical when fresh; 1 x .5 mm.

Stage I.—Head blackish brown; width .35 mm. Body colorless.

Stage II.—Head pale with a black shade across the clypeus and on each side nearly to the vertex. Body shining, colorless; the lateral outline fluted, food green; sides of thorax bulging; tail often elevated. Thoracic feet dusky and the sides of the thorax dusky spotted.

Stage III.—Head .5 mm. Much as in the next stages, but the black parts brownish and shaded.

Stage IV.—Head .8 mm. As in the next stage, but the black more diffuse. The black marks on the body are small, but the elevations are present. Thorax enlarged, fluted.

Stage V.—Head 1.0 mm., rounded, tinted with pale testaceous, almost colorless except for a broad deep black band which runs transversely across the clypeus over the eyes and turns up posteriorly to the vertex, becoming smoky; mouth brown. Feet on joints 6 to 11, none on joint 12 and scarcely a trace on joint 13, yet the larvæ sit flat on the venter on the surface of the leaf. Thorax a little enlarged; abdomen slightly tapering, smallest posteriorly. Segments obscurely 4-annulate, the first annulet broad; pale, whitish, tinged with yellow, translucent, the alimentary canal showing green. On the abdomen on joints 5 to 11 a row of large round elevated black patches stigmatally and another above the bases of the feet, a little anterior to the middle of the segments. On joint 12 the spots are smaller, absent on joint 13. On thorax a small lateral spot and a large one above the base of each leg.

Body shining; tracheæ evident where not obscured by the large spots. Thoracic feet marked with brown; abdominal ones short, colorless. There are six colorless, eversible, ventral glands on joints 6 to 11.

Stage VI.—(Ultimate.) Head pale, the marks duskily clouded; a patch over eye and streak on vertex. Body whitish, the black marks supplemented by a series of black streaks on the annulets, diffusely spreading over the dorsum. The body is scarcely shiny and does not appear sticky. Width of head .8 or 1 mm.

Found on the willow at Jefferson, N. H., and Englewood, N. J.

These larvæ are gregarious, with all the appearances of slugs, though they are really not sticky as they look, but only very shiny. The number of feet and the ventral glands shows them to belong to the Nematinæ, although from general appearance one would suppose them to be some species of *Eriocampa* or *Monostegia*.

I was much surprised that the flies should belong to *Pachynematus*. The other larvæ of this genus are solitary grass feeders, whereas a larva very similar to this species is described as that of a species of *Pristiphora*.*

TENACITY OF LIFE IN ADULTS OF CRYPTORHYNCHUS LAPATHI.

By F. M. Webster.

On August 24th, by invitation of Mr. Ottomar Reinecke, I visited the locality near Buffalo, N. Y., locally known as Beer Creek, where my friend had only a short time before discovered this species. We arrived on the ground about 3 p. m., leaving about 5 p. m., and during that time I was fortunate enough to capture eighteen specimens. These were placed in a small collecting bottle, heavily charged with cyanide of potassium, and had been prepared only a few days before. I had put in so much of the cyanide of potassium that it soon discolored the plaster parts in which it was embedded and collected so much moisture that my bottle was hardly fit for use. The specimens were placed in this bottle as collected, and remained therein until after 11:30 p. m., or from six to seven hours, when they were removed and placed in a small tight tin box. The following morning they were examined, but gave no signs of life. On returning home and opening the box, on August 29th, not only were nearly all alive, but several were found in copulation!

* *P. murtfeldtiæ* Marlatt. "A smooth greenish slug with black head, feeding on black willow." Tech. ser. 3, U. S. Dept. Agr., p. 117.

THE CORRECT TITLE: NOROPSIS ELEGANS *Hübn.*

BY A. RADCLIFFE GROTE, A. M.

There are few species of moths, the Latin name of which has been given so variously as the very pretty insect which I venture to believe should be known in the future as *Noropsis elegans* Hübner sp. It is found commonly in the West Indies and in Mexico, but within the political boundaries of the United States is only hitherto reported from Texas, so far as I am aware. Not improbably it may be found in Florida and, like the "Spanish Moth," *Xanthopastis timais*, it may be found at points further north upon the Atlantic coast line.

And first as to the specific title. The moth is first figured by Cramer under the name *Phalæna hieroglyphica;* but at that date according to Guenée and the posthumous work of Moeschler upon the lepidopterous fauna of Porto Rico, p. 149, there was already a *Phalæna hieroglyphica* of Drury, a different species. The rule is: once a synonym, always a synonym, and at that time no second species of *Phalæna*, bearing the name of *hieroglyphica*, was permissable. It was then described as *Bombyx festiva* by Fabricius, Syst. Ent. 579, according to these same authorities. I find *Bombyx festiva* in Fabricius' Mantissa, II, 127, No. 157, 1787, which has no locality and is very briefly diagnosed as: *B. alis deflexis flavescentibus basi coeruleo maculatis apice nigro punctatis* and which is probably this species. But the same or a similar objection meets us with regard to the name *festiva*. There was already, according to Guenée and Moeschler, a *Bombyx festiva* of Hufnagel. The next name is *Diphthera elegans* of Hübner. Guenée objects to this name also, because there was another noctid called *elegans*, and this objection is sustained apparently by Moeschler. But there was no *Diphthera* of that name at the time (1810). It is well known that Guenée objected to the recurrence of specific names in the same lepidopterous family as liable to cause confusion. The genera being then imperfectly limited and the structural features not well understood, there can be no doubt that the evil of duplication was strongly felt. Yet there is no rule of nomenclature which would cover such change. It is now generally recognized in Europe, that a change, made in the same work by an author in a specific title proposed by himself, should be admitted. If admitted, then there is no limitation as to the name to be changed and, in the case of the changes of his own names, proposed by

Guenée in the 3d vol. of the Spec. Gén., it makes no difference, therefore, whether the change is made by him in the first or second use of the name. It must be followed and Guenée's request be granted, because the question of priority does not come into play. We have no right to change the second use of the name, when Guenée asks us to change the first. And there is no doubt that the use twice over of the same name in nearly allied genera is productive of confusion. In my own case I was led to propose to take "*nictitans*" as the type of *Apamea*, because Ochsenheimer had a species of this name in the genus which I wrongly took to be the common *Gortyna nictitans* L. sp., whereas it is a species or variety referable to the genus *Oligia*. But we have no right to change the specific names of other writers on this account and I think that the fourth name for our species, *fastuosa* of Guenée, must be referred to the synonymy. As there has been a neglect of the "Mantissa" of Fabricius, it may be well to include this citation in the synonymy of the species.

We have now arrived at what seems to be the correct name for the species, viz: *elegans* Hübn. But a difficulty meets us as to the generic title also. The generic title *Euglyphia*, from the Verzeichniss, is preoccupied by Hübner himself, with the exception of a single letter, in the name *Euglyphis*. What is evidently the same name, even when distinguished by the change or addition of a single letter, cannot be again admitted. Here the question is quite clear from the almost identity of the terms. We cannot admit *Euglyphis* and *Euglyphia*, any more than we can admit *Oenosandra* and *Oenosanda*. The similarity would inevitably create that confusion which the rule was intended to obviate. The reason given by Herrich-Schæffer, Schm. Cuba, III, 8, for retaining *Euglyphia*, that the prior *Euglyphis* was "probably" not a valid genus, has no bearing on the case. The nomenclator is not called upon to judge of the validity of biological groups. Guenée proposed the generic title *Noropsis* for our species, while Herrich-Schæffer objects (*l. c.*) that this term is too near *Norops*, already used in zoölogy. If it were so, it would be a reason for a new term, and it is a delicate question, since the derivation is identical. But I am inclined to believe that the two are sufficiently distinct and that we may rest content in the title *Noropsis elegans* Hübn. sp., for the pretty moth and let it go at that.

DESCRIPTIONS OF TWO NEW SMYNTHURIDS.

BY NATHAN BANKS.

We hardly expect to find in the tiny, soft-bodied spring-tails the curious peculiarities that often excite our wonder in the higher groups. The differences between species too often lie in uninteresting details. Sometimes the pattern of markings or the covering of scales attract our attention, but for the most part there is much similarity in appearance. In Florida the writer collected a Smynthurid distinguished from all known species by possessing a distinct median spine on the body; it has been described by Mr. Mac Gillivray as *Smynthurus floridanus*.

Some years ago while collecting on Long Island I found a species of *Smynthurus* with clavate hairs on its back; the specimen was in some way lost, but this year I have rediscovered it. Beside the clavate hairs, which separate it from all other species, this form is also peculiar in having between the eyes two tubercles. The other species which I describe below was swept from weeds on the top of the highest hill on Long Island; it is peculiar in having at the tip of the body horn-like tubercles. This form I have named in honor of that distinguished authority on our Thysanura, Mr. Mac Gillivray.

Smynthurus clavatus, sp. nov.

Length 1.2 mm. Head yellowish, with some irregular reddish spots and a median stripe between antennæ and eyes; antennæ yellowish, darker at the tips; abdomen rich brownish, rather purplish on the sides, anal tubercle yellowish; legs pale, mottled with brownish, furcula paler, but dentes somewhat purplish. (I have seen specimens darker throughout.) Head quite broad, with two conical elevations between the eyes, and a few small tubercles bearing short stiff hairs, simple hairs in front; antennæ very short, first joint no longer than broad, second twice as long, third as long as first and second together, fourth about as long as the third, consisting of two parts, the basal the longer, the apical part tapering, only a few scattered short simple hairs on the antennæ; dorsum of abdomen with scattered large clavate hairs, simple short spike-like bristles on the anal tubercle; legs short, with one claw and a tenant hair at tip (apparently), clothed with stiff short hairs; furcula short, dentes about as long as the diameter of the anal tubercle, curved and with a few simple hairs below (when in place), mucrones one-third the length of the dentes, rather stubby, with minute teeth along the lower edge.

One specimen under loose bark of a decayed log in a swamp, October, Sea Cliff, N. Y.; two others (darker in color) escaped me. Easily distinguished by the short antennæ, tubercles between eyes, and clavate hairs on dorsum.

Smynthurus macgillivrayii, sp. nov.

Length .9 mm. Pale yellowish, whitish below, a black stripe each side starting from the eye and running back to the base of the anal tubercle, on the abdomen it is very much maculose, broader, and connected to the one on the opposite side; legs and furcula pale hyaline. Body clothed with short fine simple scattered hairs, those on the abdomen recurved. Antennæ rather long and slender, the first joint no longer than broad, the second twice as long, the third as long as both together, the fourth twice as long as the third, indistinctly subdivided into eight or nine joints, the basal one the longer; legs of moderate length, slender, apparently but one claw and a tenent hair at tip; at the tip of the abdomen near the base of the anal tubercle there is on each side a distinct conical apparently corneus horn or tubercle, seen from above they project somewhat outward; furcula of moderate length, the dentes longer than the diameter of the anal tubercle, with some fine hairs below, the mucrones remarkably short and weak, about one-fourth as long as the dentes and very much smaller in diameter, minutely serrate below.

Several specimens swept from weeds on Harbor Hill, L. I., N. Y., in May. Readily recognized by the pattern, and the tubercles at tip of the abdomen.

NOTE ON MELITTIA SATYRINIFORMIS *Hübner.*

BY WM. BEUTENMULLER.

Melittia satyriniformis HÜBNER, Zuträge Exot. Schmett. 1825, III, p. 176, 453, 454; BOISDUVAL, Suites à Buffon, Nat. Hist. Lepid. 1874, p. 471

Ægeria cucurbitæ HARRIS, New England Farmer, Vol. VII, 1828, p. 33; Am. Journ. Arts and Sciences, Vol. XXXVI, 1839, p. 310; Ins. Inj. Veget. 1st Ed. 1841. p. 232; l. c. 2d Ed. 1852, p. 253; l. c. 3d Ed. 1862, p. 331; l. c. 4th Ed. 1863, p. 330; DOUBLEDAY, Harris' Corresp. 1869, p. 161; SCUDDER, Harris' Corresp. pp. 360, 385; RILEY, 2d Rep. Nox. Ins. Mo. 1870, p. 64; REED, Rep. Ent. Soc. Ontario, 1871, pp. 99–90; THOMAS (1st Rep.), 6th Rep. Nox. Ins. Ill. 1878, p. 41; MARTIN, (Thomas' 5th) 10th Rep. Nox. Ins. Ill. 1881, p. 107; SAUNDERS, Ins. Inj. Fruit, 1883, p. 361.

Trochilium ceto WESTWOOD, Cab. Orient. Ent. 1848, pl. 30, fig. 6.

Melittia ceto WALKER, Cat. Lepid. Het. B. M. pt. VIII, 1856, p. 66; MORRIS, Synop. Lepid. N. Am. 1862, p. 335; GROTE, Check List of Moths, 1882, p. 10; HY. EDWARDS, Ent. Amer. Vol. III, 1888, p. 223; BEUTENMULLER, Ann. N. Y. Acad. Sciences, 1890, p. 20; SMITH, Cat. Ins. N. J. 1890, p. 228; Rep. Ent. N. J. 1891, p. 385; l. c. 1893, p. 503; Econom. Ent. 1896, p. 259. KELLICOTT, Can. Ent. Vol. XXIV, 1892, p. 43 and 209; Insect Life, Vol. V, 1892, p. 82.

Melittia cucurbitæ WALKER*, Cat. Lepid. Het. B. M. p. VIII, 1856, p. 66 (as var.? *ceto*); PACKARD, Guide Study of Insects, 1869, p. 279 (and other editions); BOISDUVAL, Suites à Buffon, Nat. Hist. Lepid. 1874, p. 469; COOK, 13th Rep. St. Bd. Agricul. Mich. 1875, p. 116; COLEMAN, Papilio, Vol. II, 1882, p. 50; HULST,

* Walker places *cucurbitæ* as a var.? of *ceto*.

Bull. Brooklyn Ent. Soc. Vol. VI, 1883, p. 10; LINTNER, Country Gentleman, Vol. XLIX, 1884, pp. 477, 487 and 517; 2d Rep. Nox. Ins. N. Y. 1885, pp. 57–68; SMITH, Insect Life, Vol. IV, 1891, p. 30; BEUTENMÜLLER, Bull. Am. Nat. Hist. Vol. VIII, 1896, p. 113.

Trochilium cucurbitæ MORRIS, Synop. Lepid. N. Am. 1862, p. 139.

Ægeria (*Melittia*) *cucurbitæ* PACKARD, 9th Rep. U. S. Geol. Geograph. Survey (Hayden), 1877, p. 769; FRENCH (in THOMAS' 2d Rep.), 7th Rep. Nox. Ins. Ill. 1878, p. 173;

Melittia amœna HY EDWARDS, Papilio, Vol. II, 1882, p. 53; BEUTENMÜLLER, Bull. Am. Mus. Nat. Hist. Vol. VIII, 1896, p. 113.

In my paper entitled, "Critical Review of the Sesiidæ, found in America, north of Mexico," page 113 (Bull. Am. Mus. Nat. Hist., Vol. VIII.) I made the following statements regarding our common quash-borer *Melittia cucurbitæ*. "This well-known species was described by Harris as *Ægeria cucurbitæ*, and later by Westwood as *Trochilium ceto;* consequently the former name must be used. Doubleday (Harris corresp., 1869, p. 161) states that *Ægeria cucurbitæ* is *Melittia satyriniformis* Hübner, and, if so, this latter name would have precedence. Mr. Samuel Henshaw kindly examined for me Hübner's work (Zuträge Exot. Schmett., 1825), in the library of Harvard University, and writes me as follows: "The figure of *Melittia satyriniformis* differs from all *cucurbitæ* that I have seen in coloration; the abdomen is dark blue-black with light blue margins to lack segment and without a trace of the orange so conspicuous in *cucurbitæ*." In view of this fact I thought it best to retain Harris' name until more light could be obtained on the subject. Since then Prof. John B. Smith was kind enough to examine for me Hübner's Zuträge in the library of the Academy of Natural Sciences of Philadelphia, and he writes me as follows: "The insect which Hübner figures as *satyriniformis* is without any sort of question the moth of our common squash-borer. In this copy the coloring is good and represents our insect in a male specimen. The description is more full than usual and calls attention to several little details that correspond perfectly with our insect, and I have no doubt that Hübner's figure refers to our species."

It seems to me quite evident that the plates of different copies of Hübner's works are differently colored and misleading. I have no doubt as to Prof. John B. Smith's conclusions regarding the identification of *satyriniformis*, and I would propose that hereafter *M. cucurbitæ* be called *M. satyriniformis*. The type of *M. amœna* was kindly sent to me for examination by Prof. Snow, and it is absolutely the same as *satyriniformis*, there being no differences whatever between the two.

PRELIMINARY HANDBOOK OF THE COLEOPTERA OF NORTHEASTERN AMERICA.

BY WILLIAM BEUTENMULLER.

(Continued from Vol. IV, p. 49.)

The following description of the species of *Tachys*, may be of service to those desiring to identify their species. The genus needs revision and a comparison of the types of the species must be made before any synopsis can be prepared.

T. proximus *Say.*—Head and thorax piceous; antennæ rufous; thorax transversely subquadrate, slightly contracted behind; posterior angles rectangular; dorsal line distinct, basal ones indented; elytra testaceous with a black spot on the middle hardly attaining the margin, scutellar region dusky; striæ very obtuse, obsolete, wanting at sides and apex, impunctured, intervals convex; underside piceous, paler at tip; feet testaceous. Length 2.5 mm.

Habitat: New York, New Jersey, Pennsylvania, Ohio.

T. scitulus *Lec.*—Flavo-testaceous, glossy; head dark brown, front black; thorax convex, rounded at sides, retracted behind, hind angles obtuse, not rounded; margin behind the middle reflexed; elytra broader than the thorax, elongate, somewhat convex; flavo-testaceous with a dark brown fascia behind the middle; sutural stria entire, recurved behind; second stria abbreviated; remaining striæ almost obsolete; fourth interval with a large piliferous puncture before the middle and one near the apex; marginal stria much abbreviated anteriorly; underside rufo-piceous; legs testaceous. Length, 2.5 mm.

Habitat: New York, New Jersey, Pennsylvania, Ohio.

T. pumilus *Dej.*—Rufo-testaceous; thorax subquadrate, hind angles sub-acute; elytra oblong-oval, shining bluish behind; first and second striæ distinct, external striæ obsolete, with impressed punctures; underside blackish brown; legs testaceous. Length, 2 mm.

Habitat: Illinois, Florida.

T. corruscus *Lec.*—Piceous, with a bluish reflection, shining; thorax broader than long, sides rounded, slightly retracted behind, base at each side obliquely truncate; hind angles strongly obtuse, disc slightly convex; elytra much broader than the thorax, elongate, slightly narrower anteriorly, subconvex, with two piliferous punctures; sutural stria deep, entire, almost touching the base and strongly recurved be-

hind; remaining striæ obsolete; marginal stria abbreviated anteriorly, with four punctures at the humeri; legs testaceous. Length, 2.25 mm.

Habitat: New York and westward to the Rocky Mountains.

T. ventricosus *Lec.*—Piceous, glossy; head and thorax somewhat rufous; thorax slightly convex, transverse, somewhat narrowed on each side behind, hind angles obtuse, slightly prominent; elytra ovate, broader than the thorax, bipunctate, sutural stria deep posteriorly, remaining striæ obsolete; legs and antennæ flavo-testaceous. Length, 2.5 mm.

Habitat: New York and southward.

T. lævis *Say.*—Piceous, body tinted with rufous; head rather darker; antennæ paler at base; palpi whitish; thorax transversely subquadrate, hardly narrowed behind, lateral edge not excurved behind, angles slightly obtuse, angular, basal edge nearly rectilinear, dorsal line obsolete, basal ones wanting; elytra not punctured and without striæ, except an obsolete sutural one; legs testaceous. Length, 1.5 mm.

Habitat: New York, New Jersey, Pennsylvania, Ohio.

T. pallidus *Chd.*—Elongate, head and thorax reddish-testaceous, elytra darker, tips paler; legs palpi, and base of antennæ pale testaceous; thorax broader than long, sides rounded, feebly sinuate before the hind angles which are acute, surface slightly convex; elytra slightly wider than the thorax, sides feebly arcuate, sutural stria continuous, other striæ almost obsolete, near the inner basal angle is a small circular wart-like elevation. Length, 2.3 mm.

Habitat: New Jersey.

T. occultator *Casey.*—Reddish-tetaceous, head nearly black; legs pale testaceous; form robust; thorax with sides strongly rounded, feebly sinuate behind; posterior angle rectangular, prominent; median line feeble; elytra distinctly wider than the thorax, sides feebly arcuate, sutural stria strongly marked, arcuate without, then a feeble second stria, and beyond traces of a third stria; two minute punctures; marginal stria interrupted. Length, 2.8 mm.

Habitat: New Jersey (Cape May).

T. nanus *Gyll.*—Deep black, polished, antennæ brown, base and palpi and legs rufous; thorax nearly as broad as the elytra, somewhat narrowed and slightly sinuate behind; angles rectangular, basal edge rectilinear; elytra with dorsal stria, outer striæ obsolete, impunctured, lateral stria wanting; feet piceous. Length, 2.25 mm.

Habitat: N. E. America. Usually found under bark of decaying trees.

T. flavicauda *Say.*—Black, elytra from near the middle to the tip pale yellowish; antennæ, labrum and palpi pale rufous; thorax transverse, quadrate, broadest in the middle, not contracted behind, hind angles rectangular; basal edge rectilinear; elytra with striæ impunctured, wanting at the sides and tips, intervals convex; feet pale rufous; venter piceous at the tip. Length, 1.5 mm.

Habitat: N. E. America. Common under bark of decaying trees.

T. ænescens *Lec.*—Pale rufo-piceous, head dark brown, elongate; antennæ testaceous, apex fuscous; thorax transverse, quadrate, sides slightly rounded, base on each side oblique, hind angles obtuse and a little elevated, not rounded, disc convex; elytra flat, with bluish reflection, broader than the thorax, sides almost parallel, slightly narrower anteriorly, apex truncately rounded, external striæ obliterated, punctured, with 5 or 6 striæ moderately distinct, a little deeper behind, and nearly touching the base; lateral stria broadly interrupted; under side rufo-piceous; feet pale testaceous. Length, 2.25 mm.

Habitat: Arkansas, Georgia.

T. tripunctatus *Say.*—Piceous, head and thorax darker; antennæ light brown, paler at base; palpi yellowish; thorax with the dorsal line distinct, terminating on the basal margin in an impressed puncture, on each side of which is another rather smaller puncture, basal lines much dilated and deeply undulating the posterior edge of the thorax; elytra with about four rather obtuse striæ, not extending to the tip or base, lateral striæ wanting, except a marginal one which is interrupted, on each side of scutel and on the humeri is an indention. Length, 2.2 mm.

Habitat: New York, New Jersey, Pennsylvania.

T. vivax *Lec.*—Rufo-piceous, lateral margin of elytra rufo-testaceous, dilated at the apex and humeri, thorax transversely quadrate, hind angles acute, base foveolate, sides strongly rounded before the middle, straight behind the middle, disc moderately convex, longitudinal line fine, transverse anterior impression absent, posterior deep with three large punctures at the middle; elytra broader than the thorax, convex, sutural stria entire, third and fourth striæ obliterated behind; third stria with two punctures, marginal stria interrupted. Legs testaceous. Length, 2.5 mm.

Habitat: New York, Pennsylvania, Ohio and westward.

T. capax *Lec.*—Convex, shining black; antennæ rufo-piceous, legs rufo-testaceous; thorax strongly rounded at the sides, slightly

sinuate behind, angles rectangular and with a short carina, dorsal line moderately distinct, before the base are three punctures and at each side foveolate; elytra oblong-oval, a little broader than the thorax, bipunctate, sutural stria, deep and entire, second obliterated at apex, third less distinct and lateral stria obliterated. Length, 3.25 mm.

Habitat: New Jersey, District of Columbia and westward. Allied to *T. tripunctatus* and *vivax*, but is more convex than the first and has the sides of the thorax much more rounded than the second.

T. xanthopus *Dej.*—Blackish brown, shining, antennæ at base and legs testaceous; thorax transversely subquadrate, foveolate on each side posteriorly, angles rectangular; elytra ovate, two impressed punctures, two dorsal striæ distinct, external striæ obsolete. Length, 1.75 mm.

Habitat: New York, New Jersey and westward.

T. ferrugineus *Dej.*—Rufo-piceous, elytra paler at the sides, antennæ and legs testaceous; thorax strongly rounded at the sides before the middle, straight behind, disc subconvex, dorsal line fine, posterior transverse impression deep with three large punctures at the middle; at the angle deeply impressed; elytra convex, sutural stria deep and entire, second stria abbreviated at each end, third slightly evident with two punctures, marginal stria broadly interrupted. Length, 2.25 mm.

Habitat: Massachusetts, New York, New Jersey, Ohio, Illinois, Arkansas, Colorado.

T. incurvus *Say.*—Piceous, elytra with a honey yellow line from the humeri to the apex, where it is a little dilated, antennæ honey yellow; under side piceous; legs honey yellow; thorax a little contracted gradually to the base, dorsal line slight, basal transverse line deep and wrinkled; elytra polished, with a deep sutural stria, second stria obsolete and an interrupted stria on the lateral margin; a dilated indentation each side of the scutel, and a smaller one on the humerus. The dilated vitta on each side curves near its tip a little towards the suture. Length, 2 mm.

Habitat: N. E. America. Common; in the hills of the red ant.

T. nebulosus *Chd.*—Closely allied to *T. incurvus*, but is less convex, and the thorax is less distinctly rounded at the sides and less retracted behind the middle.

Habitat: Pennsylvania.

T. granarius *Dej.*—Pale rufo-piceous, shinning, antennæ at base and legs testaceous: thorax strongly rounded at sides, and retracted behind the middle, hind angles strongly obtuse, not rounded, basal

impression deep; elytra convex, smooth, with two fine punctures, sutural stria almost touching the base, marginal stria broadly interrupted. Length, 2 mm.

Habitat: Pennsylvania, District of Columbia, Georgia, Illinois. Resembles *T. xanthopus* but lacks the second sutural stria; it is also smaller and paler in color.

T. gemellus *Casey.*—Slender, convex, dark rufous, base of antennæ and legs testaceous; thorax broader than long, sides rounded; feebly sinuate before the hind angles, which are obtuse, median line fine; elytra scarcely wider than the thorax, sutural stria fine, with traces of a second stria. Length, 2.4 mm.

Habitat: New Jersey (Cape May).

T. dolosus *Lec.*—Pale rufous, elongate, convex; thorax rather flattened, quadrate, sides slightly rounded; posterior transverse impressions deep, finely punctate; base deep, more marked at the angle; elytra broader than the thorax, elongate, smooth, distinctly bipunctate; sutural stria almost touching the base, marginal stria interrupted. Length, 2.25 mm.

Habitat: Massachusetts, District of Columbia, Illinois, Missouri, Arizona, Texas.

T. fuscicornis *Chd.*—Entirely reddish brown, with the last seven joints of the antennæ fuscous. Thorax of the form of *granarius*, with the rounded sides directed obliquely towards the base; hind angles a little prominent and acute; transverse basal impressions less deep, and has but one puncture at the middle. Elytra elongate, like those of *dolosus*, but the sides are more rounded and above are more convex. Length 2.5 mm.

(*To be Continued.*)

SOME SYRPHIDÆ FROM LONG ISLAND.

By Nathan Banks.

The flies in the list given below were taken within a few miles of Sea Cliff, L. I., N. Y. The island, or at least this portion, is not so rich as the adjacent mainland in this group of insects. Specimens are usually more rare here, and species common elsewhere are unknown, or at least uncommon, here. Such, for example, is the case with the two large species of *Heliophilus*, with *Syrphus torvus*, *Mesograpta geminata*, and others. Along the shore we find two characteristic species. *Eristalis æneus* and *Triodonta curvipes*. Among the more interesting

species may be mentioned *Baccha aurinota*, *Pterallastes thoracicus*, *Paragus tibialis* and *Neoascia globosa*.

Paragus angustifrons Loew. One, September.
Paragus tibialis Fall. Several, July.
Chrysogaster nigripes Loew. A few, June.
Chrysogaster nitida Wied. Common, June, July.
Melanostomum obscurum Say. One, May.
Melanostomum mellinum Linn. A few, July.
Platychirus quadratus Say. A few, July.
Platychirus hyperboreus Stæg. Two, July.
Syrphus arcuatus Fall. One, September.
Syrphus americanus Wied. Several, May, June.
Syrphus ribesii Linn. A few, July.
Xantogramma flavipes Loew. Several, July.
Allograpta obliqua Say. Common, July, August.
Mesograpta marginata Say. Several, July.
Sphærophoria cylindrica Say. Common, July, August.
Neoascia globosa Walk. One, May.
Sphegina lobata Loew. One, May.
Baccha lugens Loew. One.
Baccha fuscipennis Say. Common, July, August.
Baccha aurinota Walk. One, July.
Rhingia nascia Say. Common, July, August.
Volucella evecta Walk. Several, June, July.
Sericomyia chrysotoxoides Macq. One, October.
Eristalis tenax Linn. Common, April, July, Sept., October.
Eristalis æneus Fabr. Common, April, July.
Eristalis dimidiatus Wied. Several, April, July.
Eristalis transversus Wied. Several, May, July.
Eristalis flavipes Walk. Two, August.
Heliophilus conostomus Will. Several, June.
Pterallastes thoracicus Loew. One, May.
Mallota posticata Fabr. Several, July.
Mallota cimbiciformis Fall. One.
Triodonta curvipes Wied. Common, July, September.
Tropidia quadrata Say. Several, May.
Cynorhina analis Macq. Several, June.
Somula decora Macq. One, June.
Syritta pipiens Linn. Common, June, July, August.

A NEW ALEURODES FOUND ON AQUILEGIA.

By T. D. A. COCKERELL.

Aleurodes aureocincta, sp. nov.

♂. Body about 1 mm. long, blackish, with some dull ochreous markings, a conspicuous yellow spot in front of base of wings. The body is very white-mealy, so as to appear grey. Legs yellowish grey, femora blackish, knees cream color. Hind femora extending as far as tip of abdomen; forewings about twice as long as body. Base of antenna very stout. Eyes completely divided. Wings snow white, with a suffused dusky spot at end of nervure, most obvious on anterior wings. Forewings with the main nervure apparently branched just as in *Aleurodicus*, but the seeming upper branch is only a fold, as may be seen on examination by transmitted light under a compound microscope. Lower branch of main nervure arising at extreme base, so that there are practically two nervures.

Pupa, a little over 1 mm. long, oval, dorsally black, with a very broad pale marginal area, which is pale lemon yellow in specimens which have given the imago; but white in others, probably parasitized, which have not hatched. The margin of the black area is dark brown. There is no fringe, but a dark line runs close to the margin, separating a narrow marginal area which looks like a very short fringe. On the dark portion of the pupa the segments are very distinctly marked; the light marginal portion is strongly but minutely corrugated all over, something like the skin of one's finger-tips under a lens; while margin is very finely striate and feebly scalloped. The vasiform orifice is approximately an isosceles triangle, with the angles rounded, the basal side straight, the caudad sides bulging. The operculum is rounded, much broader than long, somewhat less than the outline of a hemisphere; the lingua is broad and rounded at end, and projects beyond the operculum. The lingua and operculum together have much the outline of an English "cottage loaf" of bread, except that the operculum is too broad at base.

Habitat: On leaves of *Aquilegia*, Organ Mts., New Mexico (E. O. Wooton). It is severely parasitized by *Pteroptrix flavimedia* Howd. Mr. Howard (Revis. Aphelininæ, p. 19) in recording the parasite, leaves it to be inferred that the locality is Las Cruces; the *Aquilegia*, however, does not occur there.

A. aureocincta could not well be confused with any other North American species.

INTELLIGENCE SHOWN BY CATERPILLARS IN PLACING THEIR COCOONS.

By WM. T. DAVIS.

Usually the cocoons of the American silk-worm moth (*Telea polyphemus*), fall off with the leaves in autumn, or a few dangle from the trees by a thread or two, which the caterpillars have accidently ex-

tended beyond the petioles of the leaves. During the storms of winter most of these unsecurely supported cocoons are also broken loose and complete their descent to the ground. We have found in early August an American silk-worm cocoon attached to the side of a house, about five inches from the ground, and on the 10th of last January, Mr. Chas. W. Leng and I, while walking on the ice in a Staten Island swamp, discovered one firmly woven to a forked branch of a rose bush, that stood in the water. It was as well secured to the forked branch as a *Cecropia* cocoon would have been. Of course to have fallen off with the leaves would have resulted in the death of this particular *Polyphemus*, and we presume that it was in some way the realization of this fact that caused the caterpillar to attach the cocoon so securely.

On the bushes and small trees that grow in the water on the margin of Silver Lake, on Staten Island, we have found a *Luna* moth cocoon and also an *Angulifera* cocoon firmly attached to branches. It is the habit of both of these species to construct their cocoons on the ground, but not being able to do so in the cases cited they did the next very best thing possible.

The above are perhaps not quite as interesting cases of the care taken by caterpillars to preserve their cocoons and themselves as the one mentioned in the "Proceedings of the Natural Science Association" some years ago under the caption of "Woodpeckers and Cecropia Cocoons." As is well known, *Cecropia* caterpillars spin their cocoons in a variety of places, often on fences, sometimes at the base of elder bushes and sometimes at the ends of swaying branches, when the food-plant happens to be a tree. The cocoons spun near the ground are often devoured by mice that gnaw through the silken coats to the edible pupa within. Those placed on tree branches are more safe from the attacks of mice, but are liable to be eaten by woodpeckers. On the 14th of January, 1888, I saw a Downy Woodpecker investigating a *Cecropia* cocoon in a white maple, the woodpecker thrusting its bill in and pulling it out of the cocoon quite frequently. After a while it flew to another cocoon a few feet away, but it being on such a small branch it was unable to successfully pick it open as the branch swayed up and down. It was then plain what a great protection it was to the insects to place their cocoons near the branch ends, though no doubt they are sometimes killed by the swaying of these branches during a storm.

When the woodpecker was gone, I cut the cocoon off, and found a small hole in its side quite near the branch, where it was easiest to drill because the silken fabric gave way the least to the strokes of the bird.

Cutting open the other side of the cocoon, I found that the pupa shell was sucked nearly dry of its contents. The *Cecropia* cocoons occur commonly on white maples and are generally placed near the ends of the long drooping branches, and it will be seen from the foregoing that it is probably the safest situation afforded by the tree. If a woodpecker is successful in making a hole into a cocoon, it is, nevertheless, sometimes disappointed at its contents. I have found a cocoon that contained the tough pupa case of the *Ophion* ichneumon fly, that had been drilled in the side by a woodpecker, and then abandoned, leaving the parasite unharmed.

THE CLASSIFICATION OF THE SATURNIIDES.

By A. RADCLIFFE GROTE, A. M.

The publication by Dr. Dyar* of a critical notice of my recent paper (June, 1896)† on the *Saturniides*, affords me, in replying, the opportunity of briefly stating the characters which I found in the group. I founded the two families into which the superfamily naturally divides (any other division being in my opinion unnatural) as follows:

Vein IV_2 anastomosing with IV_1 .....SATURNIIDÆ.
Vein IV_2 out of the cross-vein .....AGLIIDÆ.

Perhaps some reason should have been given by Dr. Dyar for calling this fundamental difference in the neuration "artificial," while contrasting it with a "natural classification which should combine several such special ones." But this combination does not exist; it remains ideal. It reminds one of the hazy statement, that we must take characters from all parts of the insect, which procedure, without a strict weighing of values, would lead us nowhere. But the fact is, that although I have taken the structure of the Radius as the principal character, determining as it does the dichotomous division of the superfamily, I have not left out of sight the characters of differentiation offered by the larvæ and cocoons. I have worked out the gradual modifications of the Radius in the highest of the two families. I have not "selected" a random or arbitrary character, which would in the end fail. I have been obliged to take the fundamental character which carries with it all

*Can. Ent. XXVIII, 270.

†Mittheilungen aus dem Roemer Museum zu Hildesheim, No. 6.

the rest. And this proves the value, that the character does not fail. *

The adverse statement fails, when I show, that in the larval specialization (the diminution of the tubercles and armature), the antennal structure (the attainment of the equally lengthy pectinations), the neuration and the complexity in the attachment of the cocoon, a consonant direction is held and a perfectional advance throughout the *Saturniidæ* (including *Hemileuca*). Dr. Dyar's statement that I have transposed the position accorded by him to *Hemileuca* and *Aglia* is strictly correct and, as I try to show here, entirely defensible. The former, Dr. Dyar would place with the *Automeris* group on account of the stinging spines. But I prefer to consider the eversible glands and stinging spines of the caterpillar as here characters of convergence. Their presence is explainable by the consideration that both *Hemileuca* and *Automeris* have probably arisen or diverged from a common point nearer the basis of the phyllum. It is easier to see that the stinging spines are a subordinate character when we find them again in unrelated groups: e. g. *Apodidæ*. It is not possible for me to "suppose that vein IV_2 has moved towards IV_1 in *Hemileuca* separately from the type of *Attacus* and *Saturnia* where this process is congenital." Since I show that the type is fully attained in *Hemileuca*, it is plainly already congenital in the *Hemileucinæ*. The real morphological value of this "movement" is strangely underrated by Dr. Dyar. In reality it is profound. It amounts to a reorganization of the wing through the action of the Radius upon another pattern. In a paper subsequently read by me at the Frankfort meeting, I have tried to trace the process by which the lower and more generalized Agliid wing has passed into the higher, more specialized Saturniid type. The difference, as we now find it, is, relatively speaking, primary, palingenetic, not adaptory and secondary, as appears to me the change of the armature into stinging spines.

With reference to *Aglia*, which I believe to be a specialized and very much isolated type, I regard it as having left the main Agliid stem before the devolution of *Citheronia* as we now find this group. The loss of the pair of anal tubercles is to be set down solely to the *Citheroniinæ*. I do not derive *Algia* from *Citheronia*, but from the stem before *Citheronia*. Dr. Dyar charges me with entertaining more

* Since my paper went to press, the Roemer Museum has received additional material of South American *Saturniides* in all stages. In a paper read September 23d, at the Frankfort meeting, I show that in all the new material the characters pointed out by me hold good and sustain my general classification.

beliefs than I am conscious of possessing. I think I should believe with difficulty that a purely structural character, not correlated with habit, could be twice evolved in the same limited group. But I certainly have believed that the larva of *Aglia* is derived from the main stem of the family *Agliidæ* and quite independent of the *Saturniidæ*, and I believe this still. I think that these supposed contradictory larval characters can be straightened out to accord with my classification. It seems to me that Dr. Dyar has failed to notice my genealogical tree in its vertical aspect. My friend is not impressed as I hoped he might be with this magnificent specimen of zoölogical gardening. The vertical sequence is:

Attacus,
Saturnia,
Aglia,
Hemileuca,
Citheronia.

But I have separated the interlacing branches and show that there are two natural main stems, to the higher of which I most decidedly refer *Hemileuca*. *Aglia* has so grown over toward the Saturnians that Dr. Dyar fails to find its real issue. It does not follow, because Dr. Dyar has converted me fully to the value of the larval tubercles, that I should be equally fortunate, on a much more modest scale, and bring him round to the transposition of *Hemileuca* and *Aglia*. But I may hope to do so. In my original paper I am much indebted to Dr. Dyar for information, without which I could not have cleared the superfamily from alien families which had found place in it, nor have made my paper so complete. This gratitude is not in the slightest way impaired by my attempt to rescue my classification in this one particular from an adverse criticism. I am glad of the occasion to insist upon the seeming greater reasonableness of my views.

The difficulty in the way of believing that *Hemileuca* has independently attained the type of *Saturnia* lies in the physiological steps of the progress. It appears to Dr. Dyar to be merely an approaching of vein IV_2 to vein IV_1 at base, but I have shown that vein IV_2 remains nearly quiescent; it is the cross-vein which becomes transformed so as to form a continuous part of the vein.* It is part of a general mor-

* As I have shown, the cross-vein between IV_2 and IV_1 becomes oblique in *Aglia* and *Citheronia*, and shows a step towards *Saturnia* or *Hemileuca*; therefore, so far as the radial evolution is concerned, the two first are the lower. The affinity of *Aglia* and *Citheronia* lies in the fact, that in both groups the initiatory movement is displayed. Hence I derive *Aglia* from the main stem before *Citheronia* and after *Automeris* had left it.

phological change in the structure of the wing, tending to the obliteration of the cross-vein, the permanent attachment of the two upper branches of the median vein to the Radial series and of the lower branch to the Cubitus. Such a grand alteration in the pattern of the neuration must take place through a series of gradual steps, no one of which is fortuitous. To suppose that a member of the Aglid series of a low type (vein VIII of secondaries being retained) could attain such a stage as *Hemileuca* presents, presupposes a total subversion of structural sequence. No one, I think, who had studied the neuration attentively could entertain so violent a view. I close this reply to Dr. Dyar's otherwise kind notice with a confession of my inability to understand what it is in the spacing of the analytical table which makes it unintelligible, and a recapitulation of the characters of the higher structural groups of the *Saturniides* as established by me. I conclude that the classification is plain and obvious and is preferable to the obscure characters upon which Dr. Dyar would regard *Aglia* and *Hemileuca* as types of distinct families. So far as my studies go I have found no grounds for increasing the family types in the *Saturniides*, since all the genera examined by me fall naturally and easily into their places under one or the other of the two families limited in my paper.

Radius 5-branched..... .....SPHINGIDES.
Radius 3–4-branched..... SATURNIIDES.
(1) Vein IV_2 anastomosing with IV_1.....SATURNIIDÆ.
Cell open.....ATTACINÆ. 1.
Cell closed.
Hind wings wanting vein VIII.....SATURNIINÆ. 2.
Hind wings with VIII present.....HEMILEUCINÆ. 3.
(2) Vein IV_2 from the cross-vein .....AGLIIDÆ.
Cell apically depressed.
Hind wings wanting vein VIII .....AGLIINÆ. 4.
Hind wings with vein VIII present.....CITHERONIINÆ. 6.
Cell rectangular.....AUTOMERINÆ. 5.

In view of the radius being 5-branched and the internal vein (VIII) of the secondaries being retained throughout, I consider the *Sphingides* as lower, less specialized, than the *Saturniides*. But, since both groups are parallel, both rooting in the *Tineides*, their relative position in a linear arrangement is less important and, as I say in the "Systema," I have tried to keep the original sequence of Linné where this can be done without violence. In this case there may be other points, such as the specialized larvæ, the advanced prothorax and salient head, the narrow wings and the cylindrical and tapering abdomen, all fitting the

moths for their arrowy flight, which may balance the lower type of neuration in the Hawk moths. A result of my recent studies is the recognition of the compact structure of the *Sphingides*, so that I return to a view published by me a long time ago, but since practically abandoned, that the family *Sphingidæ* is probably only susceptible of tribal division. Such an instance does not occur a second time in the Lepidoptera, the series, certainly until we come to *Acherontia*, affording me no character which seems of sub-family value, corresponding in any way to the features which I have used as basis for these groups in the *Saturniides*.

OETA FLORIDANA *Neumoegen.*

BY HARRISON G. DYAR, PH.D.

Mr. Neumoegen briefly described this form (Can. Ent., xxiii, 123) as a variety of *O. aurea* Fitch, from the upper Indian River, Florida. I have been acquainted with the larva for some time at Lake Worth and Miami, but only recently bred them to imago. The larvæ live gregariously in a large, loose and open web among the leaves of the bitterwood tree, *Simaruba glauca*. They are unusually long and slender, of a dark brown color, and remaining motionless in the web, look like pieces of sticks accidently caught in a spider's web. The pupa is formed in the same location and is colored in the same manner.

O. floridana, larva. Slender, the abdominal segments elongated, one-half longer than thick, the thoracic segments not unusually elongated. Head rounded, scarcely bilobed, prominent and proportionately large; black, a labial line, bases of antennæ, and the tubercles of the setæ white; width 2 mm. Thoracic feet large and well developed, the abdominal ones small, short, the crotchets simple, distributed rather regularly over the surface of the plant, not in rows. Setæ simple, the subprimaries present. The prothoracic shield is united with the pre-spiracular tubercle, forming a large shield, bearing the usual nine setæ; subventral tubercle with three setæ. Mesothorax with ia and ib, iia and iib, iv and v approximate, iii remote, vi with two setæ. Abdominal setæ somewhat modified on account of the lengthening of the segments; iv and v are drawn far apart and, though not more out of line than is frequent, v is slightly the more dorsad of the two, which, together with its remote position, suggests somewhat the condition found in the Sphingidæ. Tubercles i and ii are nearly in line, iv is small and vi very large; vii is composed of one large and two small setæ above the base of the foot. Otherwise normal.

Color chocolate brown; a broad orange-brown dorsal band, reaching to tubercle ii and along joints 3 to 12, contains a dorsal row of small white spots and a similar border on each side; a row of tiny white dots above tubercle iii; another broad brown band subventrally, from tubercles v to vii and joints 4 to 11, bordered above by a narrow pulverulent white line; a dark spot on tubercle vi; spiracles pale; setæ white; length 25 to 30 mm.

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NEW GENERA AND SPECIES OF NORTH AMERICAN CURCULIONIDÆ.

By MARTIN L. LINELL.

TRIBE ANTHONOMINI.

Anthonomus xanthoxyli, sp. nov.

Broadly oval, dark ferruginous, densely covered with small scales, variegated with white, gray, light and dark brown, with purplish reflection on the upper surface, and grayish white, somewhat intermixed with brown on the ventral surface and legs; beak coarsely substriately punctate, scaly and subopaque on the basal half, sparsely punctate, glabrous and shining on the apical half; antennæ slender, second joint one-half longer than the third, third equal to fourth; eyes large, protuberant, narrowly separated above; frontal fovea deep, elongate; head rugose, densely scaly; thorax transverse, rounded at the sides, broadly constricted at apex; disc densely covered with grayish and brown scales, a narrow dorsal line and a transverse one across the middle forming a white cross, the latter line broadly bordered by dark brown; elytra wider at the base than the thorax, slightly wider behind the middle, strongly declivous at apex; striæ fine, the punctures concealed by the scales; intervals nearly flat, the third at base and the suture on the declivity elevated; scutellum and two spots at its apex conspicuously white; scales of the disc variegated in grayish and pale brown, the extreme base dark brown, and of the same color is a very large triangular spot each side behind the middle not touching the suture and bordered with lighter gray; ventral segments each with a row of pale hairs; femora armed with a large triangular tooth, with scales variegated in brown and gray; tibiæ scaly at base, outwards with sparse grayish hairs; the anterior and middle tibiæ angulated one-third from base but not toothed, the posterior ones simple; tarsi sparsely hairy, pale; claws black. Length, 2 mm.

Numerous specimens collected by Mr. E. A. Schwarz at San Diego, Texas, on *Xanthoxylum pterota*, living in the seeds. Type No. 1399, U. S. N. M.

This species belongs in the subgenus *Anthonomocyllus* of Dietz, characterized principally by the widely separated middle coxæ, and is

closely allied to *A. elegans* Lec., but is smaller, less variegated and the tibiæ are unarmed.

Anthonomus brevirostris, sp. nov.

Subovate, robust, black, shining, with a slight æneous lustre, clothed with long white appressed hairs, very sparsely above, densely beneath; beak very short, scarcely longer than head and thorax, glabrous, opaque and coarsely punctato-striate behind the insertion of the antennæ, shining and sparsely punctate at apex; antennæ inserted far beyond the middle, slender, entirely testaceous, sparsely pubescent; first joint of funicle short, strongly clavate, second slender, much longer than third; following joints gradually wider; eyes feebly convex, free behind; head short, sparsely and finely punctulate, finely but deeply sulcate above the eyes; thorax broader than long, sides broadly rounded from the base, apex broadly but feebly constricted, disk very sparsely, comparatively finely punctate, each puncture with a long scale-like hair; scutellum very conspicuous by dense white scale-like hairs; elytra oval, about one-fourth wider at base than the thorax and one-half longer than wide, with striæ of distant, deep but rather fine punctures; the striæ impressed only at the side-margin and apex; intervals nearly flat, obsoletely punctulate; surface with very sparse long white hairs, condensed into spots on the base of the sixth (sometimes also at the apical fourth) and at the middle and apical fourth of the fourth intervals; pubescence of the ventral surface generally dense but all the sutures and the median line of metasternum and abdomen sparsely pubescent; legs sparsely hairy, piceous, posterior femora at base, apical half of the tibiæ and the tarsi testaceous; all the femora sharply toothed; anterior tibiæ bisinuate internally, incurved at apex; tarsi short, the first joint slightly longer than the second. Length (from apex of thorax), 2 to 2.3 mm.

Four examples collected at Brownsville, Texas, by Prof. C. H. T. Townsend. Type No. 1400, U. S. N. M.

This species belongs in the *nigrinus* group of Dietz, characterized by the third and fourth ventral segments equal in length, and should be placed with *A. faber* Dietz, from which it is readily distinguished by the sparser and finer punctuation.

Anthonomus testaceosquamosus, sp. nov.

Oblong oval, pale ferruginous, densely clothed with oval, uniformly colored, pale yellowish scales; beak very short, feebly curvate, dark ferruginous, shining; basal part to the insertion of the antennæ deeply punctato-striate, clothed with sparse scale-like hairs and some oval scales at the base, apical part glabrous, confusedly punctate; antennæ slender, testaceous with infuscate, densely pubescent club; second joint of funicle twice as long as the third; eyes large, convex; front flattened, fovea deep; thorax much wider than long, strongly rounded at the sides and broadly constricted at apex; base strongly bisinuate; surface densely and coarsely punctate; scales nearly uniform in size, oval, somewhat more condensed on the median line. Scutellum densely scaly, not different in coloration; elytra at base much wider than thorax, oval, not wider behind; striæ fine, concealed by the scales; intervals flat; scales

narrow, hairlike; anterior thoracic opening very oblique; prosternum short in front of the coxæ; scales of ventral surface oval, very dense, more narrow and less dense on the last ventral segments; legs pale testaceous, all the femora armed with a sharp tooth, tibiæ feebly bisinuate, claws black. Length (from apex of thorax), 2.5 mm

Three examples collected at Brownville, Texas, by Prof. C. H. T. Townsend. Type No. 1401. U. S. N. M.

This species should enter the *squamosus* group of Dietz next to *A. squamosus* Lec., from which it differs by its much smaller size and rounded sides of the thorax. The strongly shining beak will readily distinguish it from *A. tectus* Lec.

Brachyogmus, gen. nov.

Claws simple, divergent; hind tibiæ mucronate; prosternum short in front of the coxæ; antennal scrobes straight, directed against the eyes, but abbreviated long before reaching them; form convex, thorax narrow.

Brachyogmus ornatus, sp. nov.

Subovate, piceous, the ground color entirely concealed by large rounded scales, variegated with white, black and ferruginous; beak somewhat longer than head and thorax, cylindrical, moderately stout, slightly curvate, at base densely scaly with white and ferruginous, outwardly shining piceous; scrobes commencing two-fifths from the apex, broad and deep for about one-half the distance towards the eye, then gradually evanescent; antennæ slender; scape reaching the eye, suddenly clavate at apex, ferruginous; funicle as long as the scape, seven-jointed, darker ferruginous, each joint bearing a whorl of long stiff white hairs, first joint clavate, twice as long as the second, second to seventh subequal in length, gradually but slightly wider; club elliptical, piceous, densely pubescent; eyes moderately large, feebly convex, rounded; front wide between the eyes, depressed, with ferruginous scales; head short, the scales white, forming three broad longitudinal stripes; thorax as broad as long, very convex, broadly not strongly constricted at apex; sides strongly rounded; base bisinuate; scales white, variegated with ferruginous, on each side of the white median line a broad black stripe, variegated with ferruginous, interrupted before the apex; scutellum purely white; elytra at base fully one-third wider than thorax, twice as long as broad, slightly wider behind the middle; humeri prominent with arcuate margin; striæ narrow, deeply impressed, the punctures concealed; intervals flattened, the sutural elevated towards apex; scales variegated in white, ferruginous, black and metallic green, in the basal region around the scutellum mostly ferruginous; a humeral spot, a broad band across the suture before the middle and numerous, often rectangular, spots, forming two irregular transverse fasciæ posteriorly, are dark mixed with black and metallic; ventral surface with the scales white, mixed with ferruginous at the sides. The first four abdominal segments gradually shorter, the fifth equal to the fourth; pygidium concealed in the female, partly exposed and perpendicular in the male; femora clavate, obtusely, toothed, variegated with white and ferruginous scales; tibiæ stout, strongly mucronate at apex, variegated with white and metallic green scales, towards apex with white hairs replacing the scales; tarsi short, narrow,

piceous, clothed with white hairs; first joint scarcely longer than second, the third slightly wider; claws strong, black. Length (from apex to thorax), 2.2 mm.

Four examples collected in Los Angeles Co., Cal., by Mr. D. W. Coquillett. Type No. 1402 U. S. N. M.

This genus may be placed near *Epimechus* Dietz, from which it differs in the abbreviated scrobes and the narrow thorax.

TRIBE BARINI.

Stenobaris, gen. nov.

Pygidium completely exposed, oblique; antennæ inserted before the middle of the beak, club oval, densely pubescent, as long as the preceding four joints combined, second funicular joint as long as the next two combined; tarsal claws very small, free; anterior coxæ large, very narrowly separated; prosternum slightly convex, transversely impressed at the apical margin; beak not separated from the head, slender, cylindrical, arcuate, as long as the thorax; body slender, sparsely clothed with linear scales, not condensed into spots.

This genus should take its place near *Plesiobaris* Casey, from which it differs by the slender form, narrow prosternum, longer second funicular joint and the vestiture not forming any spots.

Stenobaris avicenniæ, sp. nov.

Elongate, lanceolate, shining, æneous, beak, antennæ and legs rufo-ferruginous; beak nearly smooth, finely punctate on the sides at base; antennæ slender, scape not reaching the eye; club piceous, the basal joint large, composing one-half of the mass; eyes feebly convex, narrowly separated above; head æneous, alutaceous, coarsely but not densely punctate, rugose and scaly between the eyes; thorax cylindrical, as long as wide, narrowed but not constricted at apex; disc very coarsely and densely punctate, each puncture bearing a narrow yellowish-white scale at the bottom, a few broader, irregular, smooth intervals between the punctures near the middle; elytra at base distinctly broader than thorax, with prominent humeri, nearly two and a-half times as long as broad; sides parallel for four-fifths the length, then arcuate to apex; striæ fine, coarser at the base, subobsoletely punctate; intervals flat, remotely transversely strigose, each striga with a small puncture, bearing a long narrow grayish-white scale; ventral surface with squamiferous punctures, rather dense on the thoracic segments, sparser on the abdomen; legs with sparse scale-like hairs; tarsi very short; fimbriate. Length, 3 mm.

Type No. 1403, U. S. N. M. Five examples in the collection of Messrs. Hubbard and Schwarz, two of which they have presented to the National Museum. They were collected at Punta Gorda, Fla. (July 14), on black mangrove (*Avicennia nitida*) and were labelled by Mr. Schwarz with the manuscript names used above. In form this insect is nearly as slender as the species of *Barilepton*.

Onychobaris rufa, sp. nov.

Oval, convex, shining, entirely rufo-ferruginous, clothed with very short, inconspicuous setæ; beak shorter than the thorax, strongly arcuate, not tapering to apex, second funicular joint one-half longer than the third; thorax scarcely wider than long, strongly constricted and tubulate at apex; sides distinctly tumid between the constriction and the middle, fully as broad there as at the base, subsinuate behind the middle; disc punctured as in *O. subtonsa* Lec., the punctures circular, less than one-third the width of the scutellum, not in contact on the middle but rugosely confluent at the sides; elytra at base not wider than thorax, scarcely one-half longer; sides behind the humeri decidedly convergent; striæ abrupt, not very broad, obsoletely punctate; intervals flat, twice as wide as the grooves, coarsely and closely but not deeply punctate, the third and fifth wider with the punctures confused, the others with single rows; anterior coxæ small, more remote than their own width; prosternum nearly flat, slightly impressed at the constriction, with two deep punctiform grooves and two obsolete rudimentary carinæ each side, the exterior one very short; abdomen sparsely punctate at the middle, densely at the sides and apex; tarsi with the first joint as long as the two following, the terminal joint as long as the three basal joints combined. Length, 3.8 mm.

Two examples were collected in the sand-dunes at Great Salt Lake, Utah (June 25), by Messrs. Hubbard and Schwarz, who have presented one of them to the National Museum. Type No. 1404, U. S. N. M.

Pachybaris xanthoxyli, sp. nov.

Form and size of *P. porosus* Lec.-Robust, convex highly polished, black, elytra, antennæ and legs rufo-piceous; vestiture very sparse of snow-white scales, smaller and narrow on the ventral surface, larger and obovate on the elytra and sides of thorax; beak slender, strongly arcuate, coarsely punctato-striate, separated from the front by a deep transverse impression; the prolongation of the antennal scrobes towards the apex broad and deep, not gradually narrowed as in *P. porosus;* head sparsely and finely punctate; thorax strongly constricted, almost tubulate at apex; disc finely and sparsely punctate, a line of coarse punctures on the apical constriction, the inflexed sides coarsely rugose; basal lobe obsoletely emarginate; scutellum small, trapezoidal; elytra with narrow, deeply impressed, feebly crenulate grooves; intervals very broad and flat, each with a single series of small scale-bearing punctures; prosternum in front of the coxæ deeply canaliculate. Length, 4 mm.

One example collected by Mr. E. A. Schwarz on *Xanthoxylum pterota*, at San Diego, Texas. Type No. 1405, U. S. N. M.

By the deep frontal groove this species approaches the genus *Linonotus* Casey, but the small scutellum and the want of antecoxal processes associate it more naturally with *Pachybaris*.

Oligolochus robustus, sp. nov.

Oval, convex, robust, shining, rufo-piceous; beak, antennal funicle and legs rufous; vestiture of dorsal surface consisting of large yellow scales, forming three broad longitudinal vittæ on the thorax, the median vitta inturrupted at middle, smaller spots

on the base of the third and fifth intervals and scattered scales along the third, fifth, seventh and ninth intervals; ventral surface and legs sparsely clothed with smaller yellowish-white scales; beak slender, a little longer than thorax, arcuate near the base, distinctly flattened at apex, strongly, unevenly punctate; antennæ inserted a little beyond the middle, scape not reaching the eye, funicle with the first joint longer than next three combined, the second somewhat longer than the third; club large, oval, densely pubescent, with the basal joint one-half of the mass; eyes flat, widely separated above, with a few large erect yellow scales at the anterior margin on the base of the beak; head separated from the beak by an obsolete constriction, alutaceous, sparsely and finely punctulate; thorax one-third wider than long, rounded on the sides, broadly constricted at apex; disc sparsely punctate at the base, more coarsely and rugosely at the constriction and on the sides; the median line smooth, entire, fusiform; a large smooth space on the disc each side, approaching the base; scutellum small, glabrous; elytra scarcely wider than thorax, slightly longer than wide, broadly arcuate from base to apex; humeri not prominent; striæ broad, deep and abrupt; intervals flat, scarcely wider than the striæ, each with a sigle row of rather coarse punctures; ventral surface coarsely and rather densely punctate; prosternum flat, separating the coxæ by about one-half their width, apical constriction entire. Length, 2.6 mm.

Type No. 1406, U. S. N. M. One example from New Jersey, presented to the National Museum by Mr. Chas. Tunison, of New York. Another specimen from the District of Columbia is in the collection of Messrs. Hubbard and Schwarz. The species resembles *O. convexus* Lec. in sculpture, but may be readily distinguished by the robust form, yellow scales and the humeri not being prominent.

Oligolochus longipennis, sp. nov.

Elongate, ovate, narrowed behind, less convex, shining, rufo-piceous, beak, antennæ and legs rufous; vestiture of narrow white scales, sparse and nearly uniformly distributed; beak slender, a little longer than thorax, regularly arcuate, scarcely flattened at apex, less coarsely, unevenly punctate; basal constriction feeble; a few erect longer scales at the margin of the eye; antennæ inserted distinctly beyond the middle of the beak; scape far from reaching the eye; first joint of funicle as long as the next three combined, the second a little longer than the third; head alutaceous, very sparsely and minutely punctulate; thorax slightly wider than long, sides slightly tumid before the middle, nearly parallel to base, broadly constricted at apex; disc coarsely and densely, on the sides and at the constriction rugosely, punctate; a smooth median line, abbreviated each end; the white scales uneven in size, on the sides and along the base larger, on the middle of the disc very small and inconspicuous; scutellum small, with a couple of scales; elytra not wider than thorax, one-half longer than wide, strongly narrowed from the humeri and compressed on the sides near the apex; humeri not prominent; striæ deep and abrupt, moderately wide; intervals flat, each with a row of rather coarse scale-bearing punctures, the scales forming a spot on the base of the third interval; ventral surface coarsely and densely punctate; prosternum flat, separating the coxæ by one-half their width, apical constriction entire; legs sparsely punctate and scaly. Length, 2.8 mm.

One example from Burnett Co., Texas.

Type in the collection of Messrs. Hubbard and Schwarz.

This species is easily distinguishable by the densely punctate thorax, the uniformly distributed scales and the elongate form, tapering behind.

Zygobaris cœlestina, sp. nov.

Robust, subrhomboidal, convex, glabrous, strongly alutaceous, opaque, intensely dark blue; beak separated from the front by a shallow depression, short, arcuate, cylindrical slightly flattened at apex, shining, sparsely punctate, basal half bluish green, apical half piceous; mandibles short, decussate, strongly bifid at apex; scrobes deep, directed inferiorly; antennæ inserted a little beyond the middle of the beak, ferruginous, the scape not quite reaching the eye; funicle stout, the first joint as long as the three following combined, the second and third subequal, the outer joints gradually wider; club oval, pointed, finely tomentose; eyes large, flat, widely separated above; frontal fovea small, punctiform; head globose, sparsely and finely punctulate; thorax scarcely wider than long, conical; sides somewhat rounded; apical constriction broad and feeble; disc sparsely and finely punctate, more coarsely at the sides, without trace of median line; scutellum small, smooth, shining green; elytra at base slightly wider than thorax, gradually, moderately narrowed behind, broadly rounded at apex; humeral callus at base of seventh interval conspicuously elevated; striæ linear, distinctly impressed, with remote fine punctures, much larger at base between the scutellum and humeral callus; intervals flat, each with a single series of remote, small, submuricate punctures; thoracic segments beneath coarsely and deeply but not very densely punctate, each puncture at the bottom with a small narrow white scale; prosternum flat, separating the coxæ by their own width, with a small shallow depression near the apical margin enclosing two large deep punctures; ventral segments finely, very sparsely, apical half of the fifth very densely, punctate; legs bluish green, alutaceous as the body, sparsely finely punctate, each puncture with a short white hair; tarsi short, ferruginous, fringed with grayish hairs; third joint moderately broad, bilobed; claws small, distinctly connate at base. Length, 4 mm.

Type in the collection of Messrs. Hubbard and Schwarz, taken at Cocoanut Grove, Fla. (April 25). Mr. Schwarz informs me that another specimen is in the collection of Dr. Horn.

Catapastus signatipennis, sp. nov.

Robust, rhomboidal, convex, black, somewhat shining; antennæ and legs piceous; beak as long as thorax, strongly curvate, piceous; base thickened, coarsely rugose and squamulate, the basal constriction distinct; apex glabrous, punctato striate; antennæ inserted beyond the middle of the beak; scape not reaching the eye; first joint of funicle as long as the next four combined, second equal to third; club oval, large; head nearly glabrous, alutaceous, obsoletely punctulate; thorax wider than long, conical, distinctly constricted at apex, coarsely and densely punctate, densely covered with rounded scales, forming a broad brown band along the middle and yellowish white on the sides; a denuded spot on each side of the basal lobe; elytra distinctly wider than thorax, broadly rounded and feebly convergent on the sides,

rounded at apex; striæ narrow but abrupt; intervals broad, flat, sparsely, confusedly and subrugosely punctate; vestiture sparse, of brown narrow scales and broader yellowish ones; the latter forming a spot at the base of the third interval and a large W-shaped mark across the suture at middle; ventral surface rather sparsely punctate, each puncture bearing a narrow white scale; prosternum separating the coxæ by one-half their width, broadly sulcate, the sulcus deeper in front and with two deep punctiform foveæ at the constriction; legs sparsely punctulate, each puncture with a narrow white scale, the femora exteriorly towards apex with brown scales; tarsi very short, fringed with white hairs; claws parallel, connate at base. Length, 2 mm.

Four examples collected at Key West, Fla., by Mr. E. A. Schwarz, two of which are presented to the National Museum by Messrs. Hubbard and Schwarz. Type No. 1407, U. S. N. M.

Catapastus albonotatus, sp. nov.

Rhomboidal, convex, piceous black, very sparsely clothed with scattered white scales, very narrow and small on the ventral surface and larger but still sparser on the thorax and elytra, collected into small spots on the base of the second interval, on the base of thorax opposite the humeral umbone and on the base and apex of the episterna of metathorax; beak thick, not flattened at apex, strongly curvate and abruptly bent at middle, coarsely striato-punctate, with a few minute scales towards the base; basal constriction obsolete, the upper margin of the eye with a white scale; antennæ inserted beyond the middle of the beak, piceous, the scape not reaching the eye; funicle with first joint obconical, second scarcely longer than third; club large, oval; head sparsely punctulate; thorax as long as wide, slightly rounded at the sides, feebly constricted at apex, only moderately coarsely punctate, the punctures separated by about their own diameter; smaller scales wanting, the large white scales about a dozen outside of the basal spot; scutellum glabrous; elytra at base wider than thorax; sides behind the humeri strongly convergent; striæ narrow, remotely not conspicuously punctate; intervals flat, each with a series of small remote punctures and fine transverse strigæ; the white scales mostly on the third, seventh and ninth intervals; ventral surface sparsely punctate; prosternum separating the coxæ by nearly their own width, broadly impressed, with two punctiform foveæ at the constriction; legs piceous, sparsely punctulate; tarsi short, ferruginous, fringed with white hairs. Length, 1.7 mm.

Type No. 1408, U. S. N. M. One specimen in the National Museum from Lake Worth, Fla., presented by Mr. Ottomar Dietz, of New York; another one exactly similar in the collection of Messrs. Hubbard and Schwarz from Key West, Fla. In the latter collection is a third specimen also from Key West, which has more numerous scales above, condensed into three vittæ on the thorax; the spots are diffused and the beak and legs ferruginous, but there is no difference in sculpture. The glabrous scutellum with a spot each side at once distinguishes this species from *C. conspersus* and *C. diffusus*.

LIFE HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—X-XI.

PLATES III-IV.

By HARRISON G. DYAR, A.M., PH.D.

Euclea delphinii *Boisduval.*

1797—*Phalæna cippus* ABBOT & SMITH, Lep. Ins. Ga. II.
1832—*Limacodes delphinii* BOISDUVAL, CUVIER'S An. Kingdom (Griffith), pl. CIII, fig. 6.
1841—*Limacodes cippus* HARRIS, Ins. Inj. Veg. 303.
1854—*Limacodes querceti* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 174.
1854—*Limacodes quercicola* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 175.
1855—*Euclea cippus* WALKER, Cat. Brit. Mus. pt. V, p. 1143.
1855—*Euclea viridiclava* WALKER, Cat. Brit. Mus. V, 1154.
1860—*Euclea pænulata* CLEMENS, Proc. Acad. Nat. Sci. Phil. XII, 159.
1860—*Nochelia tardigrada* CLEMENS, Proc. Acad. Nat. Sci. Phil. XII, 160.
1864—*Euclea monitor* PACKARD, Proc. Ent. Soc. Phil. III, 337.
1864—*Euclea ferruginea* PACKARD, Proc. Ent. Soc. Phil. III, 337.
1864—*Euclea bifida* PACKARD, Proc. Ent. Soc. Phil. III, 338.
1882—*Euclea querceti* GROTE, Check List, 17.
1882—*Euclea quercicola* PILATE, Papilio, II, 67.
1887—*Euclea elliotii* PEARSALL, Ent. Amer. II, 209.
1891—*Euclea cippus* DYAR, Trans. Am. Ent. Soc. XVIII, 151.
1891—*Euclea cippus* var. *interjecta* DYAR, Ent. News, II, 61.
1891—*Euclea cippus* SMITH, List Lep. 28.
1892—*Euclea querceti* KIRBY, Cat. Lep. Het. I, 547.
1894—*Euclea delphinii* NEUMOEGEN & DYAR, Journ. N. Y. Ent. Soc. II, 67.

LARVA.

1832—BOISDUVAL, Cuvier's An. Kingd. (Griffith), pl. CIII, fig. 7.
1860—CLEMENS, Proc. Acad. Nat. Sci. Phil. XII, 160.
1878—ANDREWS, Psyche, II, 272.
1881—FRENCH, Papilio, I, 144, 145.
1890—PACKARD, 5th Rept. U. S. Ent. Comm. 144.
1891—DYAR, Trans. Am. Ent. Soc. XVIII, 152.
1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 89, 101.
1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 214.
1895—COMSTOCK, Man. Stud. Ins. 223; fig. 258.

SYNOPSIS OF VARIETIES OF THE MOTH IN NEW YORK.

Form delphinii. Green confined to a small triangular basal patch and subapical dots (plate III, fig. 1).

Form querceti. The basal green patch has a short projection on the outer side (plate III, fig. 2, left wing).

Form interjecta. A row of green dots connects the basal and subapical green marks (plate III, fig. 3, right wing).

Form viridiclava. The green forms a continuous band, bordering the cell, notched on the outer side (plate III, fig. 4).

Form elliotii. The green band encroaches on the cell, or even surrounds the discal dot (plate III, fig 5).

SYNOPSIS OF VARIETIES OF THE LARVA.

Form A.—Flesh colored, horns and ridges bright red shading to pinkish; black lines all present, waved, confluent, forming irregular areas about the glandular dots; no quadrate spots; often no detachable spines (plate III, fig. 9).

Form B.—Sordid purplish, the black lines shaded; horns and ridge broadly bright ferruginous, broken on the interspaces, 6–7, 9–10 and 11–12 by quadrate dark brown spots.

Form C.—Dorsum sordid purplish, sides green; marks as in form B (plate III, fig. 6).

Form D.—Green, the black lines faint; horns and ridge yellow, broken by quadrate spots as in form B (plate III, fig. 8).

Form E.—Green, the ridge and horns red; quadrate brown spots on joints 3–4, 4–5, 6–7, 9–10 and 11–12 (plate III, fig. 7).

SPECIAL STRUCTURAL CHARACTERS.

These characters have been already given for the Florida form (see Journal N. Y. Ent. Soc., iv, 125). In the New York forms there are usually no caltrope patches on the subdorsal horns of joint 13. The patch on the lateral horn of joint 12 is present when there is only one pair of detachable spines (on joint 13), but absent when the second pair is present, and even absent in stage vii, before the spines have appeared, so that it may be determined in this stage whether there will be one or two spine patches. The second pair of spine patches appears above this horn (lateral of joint 12) and replaces the caltropes functionally; but probably the spines are not homologous with caltropes as we formerly supposed (Journal, iv, 3, foot note) since both may be present on the same horn and the caltropes abruptly disappear before the spines, not being converted into them.

Our larvæ do not hide by day so persistently as the Florida form, though the habit is present in some degree.

AFFINITIES, HABITS, ETC.

The range of variation in the moths as they occur in New York is illustrated on the plate (figs. 1 to 5). The variation of the amount of green on the fore-wings is from *delphinii*, the minimum, to *elliotii*, the maximum. The ground color also varies from dark ferruginous brown

to ocherous brown and the bright red shade bordering the green outwardly may be distinct or wanting.

The forms have a certain dependence on locality. In the Hudson valley the *delphinii* form predominates, rarely becoming as green as *viridiclava*; on Long Island the tendency is towards green and the *elliotii* form is frequent. The species ranges to the South, our locality being toward its northernmost extension. In the southern part of Florida the *delphinii* form appears, approaching the true *cippus* of Dutch Guayana. According to Cramer's figure, *cippus* is a brown moth with three green patches, the third at the end of the cell, apparently. This is a form which our species has no tendency to assume, and if it really extends into South America, it is more likely to be represented by *Euclea æmilia* Stoll, which differs from the *delphinii* form in having the basal patch yellow, instead of green, a variation which is occasionally indicated in New York specimens.

Euclea dicolon Sepp, is also nearly related, but has a very differently colored larva. In the Mississippi valley and Texas, the forms *pænulata* and *incisa* occur. The larva of the latter is unknown and I have no opinion as to its relation to our species; but the larva of *pænulata* as described by Professor French does not differ from those which have produced *viridiclava* and *elliotii* here. The moth of *pænulata* is only slightly more green than *elliotii* and it seems probable that it is a variety of our species.

The variation in the larvæ is considerable. In our preliminary synopsis (Journal III, 146), we recognized *pænulata* as distinct from *delphinii* on the characters of the number of detachable spine patches and coloration; but further experience renders this view untenable. There is a certain local tendency coupling the forms of larvæ with the moths as indicated in our table. In the Hudson valley the larvæ are generally green with red or yellow horns, the subdorsal band broken by brown spots and the four spine patches well developed. On Long Island the terra cotta form prevails, though not exclusively, without the brown spots and with feebly developed spine patches. However, rarely the terra cotta colored form has four spine patches; such a larva produced a moth of *elliotti*. Then the Florida larvæ, having the characters of *pænulata* in the unbroken subdorsal band and single pair of spine patches, but the green color of *delphinii*, have recently been described in this journal. The moths were *delphinii*, and thus all the differential characters have vanished, leaving a single variable species with a tendency towards local forms.

The species is single brooded in New York. The moths fly in the last of June and in July. The eggs are deposited in the evening, before ten o'clock, usually singly, or but few together, not in the rather large patches of *Sibine*. They hatch in seven days. The larvæ pass through the usual eight stages, occasionally nine. In this case a stage is interpolated between the last two. It usually is like stage VII, but may be like the last stage with the presence of detachable spines. The first stage is quickly passed through without feeding, but afterwards development is more slow. Mature larvæ may be found in September.

The coloration of these larvæ is much less conspicuous than that of *Sibine stimulea* and their defensive armor is weaker in proportion, the spines being distinctly less venomous.

Miss Morton has obtained fertile eggs of the Long Island form from cocoons collected by Mr. Doll. The youngest larvæ which I have found in the field have been in stage III.

CRITICISM OF PREVIOUS DESCRIPTIONS.

The references to Abbot & Smith, Harris, Morris, Packard and Duncan, given in Edwards' catalogue of transformations of N. A. Lepidoptera under the heading *E. cippus*, do not refer to this species, but to *E. indetermina* or *S. stimulea*. The present references are to descriptions or figures of the mature larva and cover the principal colorational forms. This larva has been on the whole so slightly investigated that there is little of a positive nature to correct. Dr. Packard's latest description is full and very good. He says "there seem to be no caltropes . . . in the cuticle of this genus," but above (page 90) he describes "a pale brown patch like a mass of sand" on the upper side of the lateral horns of joints 6 to 11, which are really the patches of caltropes, though he failed to recognize them. The detachable spines are correctly located, but not described in detail. The lateral horns are not referred to their respective segments, and the position of the spiracle on joint 5 is not described.

Dr. Packard's remarks on page 91 agree with my own views, except that I regard this species as tending to become protectively colored, the bright warning color having partly disappeared. Hence the habits of concealment exhibited by the larvæ.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

My description of these stages of the Florida form will suffice for the New York ones. At first all are alike, though the mature larva is

so various. There is usually no permanent color till stage IV and after that the differently colored larvæ gradually differentiate themselves. I have followed out the full life history of the Long Island form in two instances, but do not find enough to warrant redescribing the stages in full.

Food-plants.—Oak, chestnut, bayberry, *Andromeda*, beech, sour gum (*Nyssa*) and wild cherry.

EXPLANATION OF PLATE III.

Fig. 1. *Euclea delphinii*, natural size.
" 2. Form *querceti*.
" 3. Form *interjecta*.
" 4. Form *viridiclava*.
" 5. Form *elliotii*.
" 6. Larva from Dutchess Co., form C.
" 7. The same, form E.
" 8. The same, form D.
" 9. Larva from Long Island, form A.
" 10. A short horn of subdorsal row × 45, with adjacent skin granules.
" 11. A detachable spine of the Florida larva × 175.
" 12. The same from a Long Island larva with one pair of patches.
" 13. The same from a larva with two pairs of patches.
" 14. A spine without the basal bulb; rare; × 175.
" 15. An unusually short spine; Florida larva.
" 16. A caltrope from among the detachable spines.
" 17. Caltropes in position on a lateral horn × 175.

Parasa chloris *Herrich-Schäffer.*

1854—*Neæra chloris* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 176.
1864—*Limacodes viridus* REAKIRT, Proc. Ent. Soc. Phil. III, 251.
1881—*Farasa fraterna* GROTE, Papilio, I, 5.
1882—*Parasa fraterna* GROTE, Check List, 17.
1891—*Parasa chloris* DYAR, Trans. Am. Ent. Soc. XVIII, 154.
1891—*Parasa chloris* SMITH, List Lep. 28.
1894—*Parasa chloris* NEUMOEGEN & DYAR, Journ. N. Y. Ent. Soc. II, 72.

LARVA.

1864—REAKIRT, Proc. Ent. Soc. Phil. III, 251.
1887—HY. EDWARDS, Ent. Amer. III, 169.
1891—DYAR, Trans. Am. Ent. Soc. XVIII, 154.
1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 91.
1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 217.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space broad, of nearly even width, except at the extremities, where it narrows considerably. The dorsum rises abruptly to a maxi-

mum at joint 5 and then slopes to the tail, the slope becoming steeper after joint 11. Lateral space broad, nearly perpendicular and continuous in direction with the broad, not retracted subventral space. Subdorsal ridge well indicated by the abrupt change in direction between back and sides; lateral ridge slight; subventral edge prominent, two setæ on each segment. Horns at first as well developed as usual in the group (larvæ of type 2), but soon reduced, finally to small rounded spinose buttons. The subdorsal horns of joints 3, 4, 5, 8, 11 and 12 remain longer than the rest; that on joint 13 becomes early consolidated with its fellow into a tail directed posteriorly, at first cleft and spiny, later more uniform. The lateral horns are all small, subequal, situated on joints 3, 4, 6 to 12 as usual. The head is concealed under joint 2, but this joint is scarcely retracted, its spiracle remaining exposed by a lateral retraction of joint 3. The spiracle on joint 5 is moved up out of line with the rest, all being plainly visible, as the whole subventral region is freely exposed.

After stage I, the spines on the horns are of the stinging type, but they are gradually reduced in size and number and become functionless. In the last stage they are so much aborted that they are imperfectly erected after the molt and the group remains pointing inward over the back in the case of the larger horns. The small, black, piercing caps remain and the spines do not become setiferous, except in the case of some of the smallest anterior horns.

Depressed spaces feebly developed, represented by black spots; (1) round, distinct, paired; (2) and (3) tiny dots, segmental; (4) distinct, narrowly elongated and slightly oblique, in the middle of the lateral space; (7) slightly elongated, alternating with the spiracles; (8) a tiny dot above the subventral edge.

Skin covered with very small, dark, pointed spines, which become round, clear granules just above the subventral edge only. Small patches of caltropes are present on the upper side of the reduced lateral horns on joints 6 to 12. No detachable spines.

AFFINITIES, HABITS, ETC.

This larva seems to represent a recent offshoot of the main stem of the spined Eucleids. In its first stages it is very closely allied to *Euclea*, but finally the colors and armor degenerate and the shape is altered to one adapted for concealment. This direction of modification is indicated in both *Euclea delphinii* and *Adoneta spinuloides*, but here it is fully carried out. The tail, which is so like that of *Packardia* and *Euli-*

macodes, is homologous with neither, as it is composed of the two subdorsal tubercles of joint 13 united, and not of a simple prolongation of the body. While the larva departs so widely from the primitive form of the spined Eucleids, the moth is generalized. I take the green thorax and band on the fore wings to be the primitive pattern of maculation, as it appears almost identically in both this species, and *Euclea indetermina*, whose larva are so different, and reappears in many South American and Indian species. *P. chloris*, then, is a form belonging to the most typical group of spined Eucleids, the moth unmodified, but the larva recently specially adapted.

The larvæ are found on the lower branches of trees, not on low bushes or brush. A rather low overhanging limb in a well shaded place is a favorite location. The eggs are laid singly, but often several on the same leaf and not infrequently of two or more ages, as different moths tend to select the same branch for oviposition. The eggs are laid from the middle to the end of July; the larvæ become mature at the end of August and during the most of September. They rest on the undersides of the leaves, feeding singly.

Eggs of this species occurred to me rather numerously at Bellport, Long Island, and this life history was worked out from them. The eggs are not as difficult to detect as usual on account of their proportionate large size.

CRITICISM OF PREVIOUS DESCRIPTIONS.

The published descriptions refer only to the mature larvæ, and are not as full as could be desired. Both Edwards and Packard speak of the subdorsal horns as "retractile tubercles." I think this term misleading. The horns have the normal structure, though short and degenerate, and only appear to be retracted by the movements of the flexible skin. Dr. Packard figures the spines and skin spinules (compare Plate IV, figs. 12, 13 and 14) with rather small magnification; but no one else has even attempted to treat of the finer structure, and the early stages have been altogether neglected.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—(Plate IV, fig. 8.) Elliptical, flat, transparent and very shining; 1.6 × 1.2 mm. Reticulations angular, linear, irregular, distinct. The leaf is perfectly visible through the eggs, which resemble spots of moisture or some clear gummy substance.

Stage I.—(Plate IV, figs. 1 and 2.) Elliptical, dorsum broadest centrally, narrowed at the large horns; sides perpendicular. Horns

arranged exactly as in Euclea, from which the larva is indistinguishable. Color all opaquish white, no marks. Length 1.2 mm. The larva does not feed in this stage.

Stage II.—Horns rounded, large, the subdorsals on joints 3, 4, 5, 8, 11 and 12 with many black-tipped spines, those on joints 6, 7, 9 and 10, with one or two spines. Lateral horns moderate, rounded, spined. Color all ground glass white. Skin finely granular; segmental incisures cleft-like; depressed spaces not indicated. Body widest at joint 5, narrowing a little toward the ends. Subdorsal horns on joint 13 small, approximate, projecting posteriorly to form a subquadrate tail. Later a chocolate brown shade appears dorsally on joints 3 and 4, the highest part of the body, which slopes backward from this point. Toward the end of the stage the full markings of the next stage may be assumed. Length 1.2 to 2.1 mm.

Stage III.—Elongate, the sides parallel, joints 3 and 4 a little the highest; subdorsal horns elongate rounded, those on joints 3, 4, 11 and 12 large, 8 moderate, the rest with but one or two spines; lateral horns very small with five or six spines, those on joints 3 and 4 the largest. Color honey yellow, a white line along subdorsal ridge, the pair connected by a narrow angular bridge on joints 5 and 11; dorsum on joints 3, 5 and 11 chocolate brown; a brown line along the lateral horns. Depressed spaces (1) and (2) indicated, faint, also the large lateral ones (4). Skin nearly smooth, finely remotely granular or punctate. The tail horns are partly fused into a short, cleft, spiny process; spines black tipped; head pale brown, eye black. Length of larva 2.1 to 3 mm.

Stage IV.—As before, the dorsum rather broad. Long horns large, rounded, whitish, with brown tips, short spined, the one on joints 8 and 13 white. Short subdorsal horns and the lateral ones of joints 6 to 12 small, inconspicuous, concolorous; a short notched tail. Body all brown, except a space in the dorsum on joints 6 to 10, which is greenish; a narrow white subdorsal line with white bridges as before, but on joints 5, 11 and 12; a white line along the subventral edge; a faint darker line along the lateral horns. Largest depressed spaces moderate; skin as before. Length, 2.9 to 4.5 mm.

Stage V.—Dorsum of joints 3, 5, 11 and 13, lower half of sides and tips of subdorsal horns on joints 3 to 5 dark brown; the rest of the body fleshy brown; dorsal vessel greenish; a fleshy pink tint along the subdorsal ridge with a narrow bridge on joints 5, 11 and 12; a pink line along subventral edge. Bases of subdorsal horns on joints 3 to 5, all of horns 8, 11 and 12 and the short, approximate tail-like pair fleshy pink;

other horns obscure. A broken, double, waved, pale addorsal line. Depressed spaces very obscure. Skin sparsely, very finely granular. Horns moderate, with slender, black-tipped spines. The anterior end of the larva is darkly colored, joint 11 conspicuously pale. Length 4.4 to 6.2 mm.

Stage VI.—Horns rounded, small, the subdorsals on joints 11 to 13 pinkish white, the rest brown, concolorous; proportions as before, tail cleft. Body dark-brown dorsally, and on the upper half of the sides, marked with paler as before; the lines on the ridge and the bridges rather faint. Central dorsal and waved addorsal faint, broken white lines. Horns all spined, but the spines on joints 4 and 5 point inward, not erected. Length 5.9 to 8.5 mm.

Stage VII.—(Plate IV, fig. 9, ventral view). Fleshy brown; dorsal and waved addorsal broken, segmentary, salmon marks; thorax and subventral edge shaded darker; subdorsal horns of 11 light. Horns short, rounded; tail slightly cleft, spiny. Dorsal paired dark dots (1) joined by a whitish band; (4) oval, dark, narrow holes low down on the sides. A narrow salmon line along the subdorsal ridge edged with dark above; sides with four salmon lines; a conspicuous pinkish line along subventral edge, bordered above by crimson and brown. Horns all dark except the subdorsals on joints 11 to 13; the long ones form rather large buttons. The shape is like the mature larva. Length 7.5 to 13 mm.

Stage VIII.—Tail pointed, spinose sometimes still cleft. Caltropes present (Plate IV, figs. 13 and 16) on the lateral horns of joints 6 to 12 in a large patch, the caltropes themselves with larger side spines than usual. Skin finely, rather densely spinulated (Plate IV, figs. 10, 13 and 14), much as in *Sibine stimulea*. Color without dark shades, the ground a sordid greenish marked with the numerous waved salmon-colored lines (Plate IV, figs. 3, 4 and 5), brighter posteriorly. There are five in the dorsal space, five in the lateral space, all somewhat confused. A narrow blackish line on subdorsal ridge, none on the lateral one. Subventral edge broadly pink, edged above by a dark red line. Depressed spaces (1) small, paired; (4) narrow elongate; (7), round, pit-like; (8) indicated, all blackish—no others. Horns short, the large ones with the spines turned in (Plate IV, fig. 11) dark, those on joints 11 and 12 whitish, contrasting. Shape as described above. In some examples the posterior portion of dorsal space is of a very bright, fiery color. Length 10.6 to 20.3 mm.

Food-plants.—Oak, chestnut, wild cherry, hickory and bayberry.

EXPLANATION OF PLATE IV.

Fig. 1. Larva stage I, side view.
" 2. The same, front view,
" 3. Mature larva, enlarged, side view, feeding.
" 4. The same, front view.
" 5. The same, back view.
" 6. Feeding traces of stage II.
" 7. The same of stage III.
" 8. Egg.
" 9. Ventral view of larva, the body shrunken preceding a molt, enlarged.
" 10. Skin granules at subventral edge, grading into the general spines above.
" 11. One of the large horns of subdorsal row, the spines imperfectly erected × 50.
" 12. Tip of spine, more enlarged.
" 13. Horn of lateral row, showing caltrope patch and skin spines.
" 14. Skin spines of same region, more enlarged.
" 15. Spines from a different region.
" 16. Caltropes, × 225.
" 17. *Parasa chloris*, natural size.

NOTE ON MR. GROTE'S REMARKS ON THE SATURNIANS.

By HARRISON G. DYAR.

Mr. Grote's reply to my criticism on his paper "Die Saturniiden" is disappointing. I had hoped that he would adopt my suggestion to take three or four entirely different characters, work each out independently in the same manner as he has done for vein IV^2 of primaries and let the evidence from these show whether his classification or mine was the nearest the natural one. Instead Mr. Grote defends his classification on the original grounds and misstates (unintentionally of course) and belittles the larval characters. The matter is certainly simplified by "setting down the loss of the pair of anal tubercles solely to the Citheroniinæ." The only objection that I know to this ingenious solution is that it is not a statement of fact. But, seriously, it remains that the genealogical tree deduced by Mr. Grote is contradictory to the one that I have made on larval characters. My original statements are not affected, so far as I can see, by Mr. Grote's insistance on the importance of his characters; it is open to me to insist equally on the importance of mine. Collateral evidence only can decide the question, and this Mr. Grote has not adduced. In reply to Mr. Grote's kind wish to convert me to his views, I again point out the path to that end, or at least the path which must lead to the end of a mutual agreement, whether on Mr. Grote's system or mine, or some other more natural one, which we neither have thought of.

THE PROTECTIVE VALUE OF ACTION, VOLITIONAL OR OTHERWISE, IN "PROTECTIVE MIMICRY."*

BY F. M. WEBSTER.

Whatever in the form, color or actions of an organism tends to enable it to escape from its enemies, or more readily secure a proper supply of food, is, to a certain extent, protective in its effects. Forms, not in possession of such advantages, will, in case of an unusual abundance of enemies, or a deficit in the supply of food, be the least likely to survive. In this paper it is the intention of the author to discuss only such cases of "protective mimicry" as require some special movements, or the assumption of some peculiar or unique position, on the part of the protected form, in order to continue or complete the deceptive effects of its shape, color or coloration.

There are a number of insects that, prepared and placed in our cabinets, have comparatively little resemblance to each other, while in the midst of life and activity, are distinguishable from each other only with extreme difficulty. An example may be found in *Podosesia syringæ* Harr., which somewhat resembles *Polistes annularis* Fabr., in form, while its movements are almost an exact reproduction of those of the latter species, which is an armed wasp, while the former is a helpless moth. The Varying Hare, *Lepus americanus virginianus* Harlan, no doubt derives more or less protection from the color of its fur, but this protection does not appear to be supplemented by any correlative action on the part of the animal itself.

Many naturalists object to the use of the term "protective mimicry," for the reason that it implies mental capabilities supposed to be confined to the human race. The statement is made, and by those whose opinion is worthy of the greatest respect and most careful consideration, that the influences of natural selection are amply sufficient to account for all such phenomena, and that we do not need to assume the presence of volition as a factor in such phenomena. In some quarters the initial step, in an investigation of the phenomenon of "protective mimicry," is to close the door, so to speak, against any possibility of the most primitive kind of intelligence, on the part of the mimicing species, while to admit that a mimicing insect has any conception of its own appearance, is the most dangerous sort of heresy. Now there are

* Read before the Ohio State Academy of Science, December 30, 1896.

quite a large number of zoölogists who both work and think, who do not believe that natural selection is adequate to explain all of the phenomena that come to the notice of the naturalist, and as a leader of those who hold this view, we have that venerable thinker, Herbert Spencer. It is clear enough that natural selection will maintain or even perfect what has already been begun, but that it can set the machinery of protective mimicry in motion—can bring a case of protective mimicry or coloration into existence, seems extremely doubtful. In the first place, we must remember that "self-preservation is the first law of nature," even in man. No human being will voluntarily take his or her own life unless mentally deranged, or as a sacrifice to some great and important principle, or to save the lives of others. Old and battle-tried soldiers, whose acts of bravery have become known from one side of the world to the other, have acknowledged that the impulse to break and run, when first going into battle, had each time to be overcome. If self-preservation is the first law of nature, then fear and the sense of pain are the police powers, so to speak, that enforce the law. The soldier who drops his gun and runs away, instead of facing the enemy, has allowed the fear of pain or death to overcome his sense of duty and he seeks a place of greater safety; seeks to preserve his life. Among all animal life below man, we find a different condition to exist, in that the whole aim and object of life is to reproduce. The same phenomena may be observed, even among plants, the whole of the remaining vitality of an injured tree or a girdled vine, being exhausted in producing a few seeds or seed inclosing fruit. In fact, almost a parallel may be observed to some extent among consumptive men and women. Among lower animal life, unless the young require the protecting care of the parents, as soon as this duty of reproduction is accomplished death, generally speaking, occurs, although among insects the period of reproduction may vary from a few hours to several years, according to species. Protection, in the egg stage, is usually accomplished, where such is needed, by the mother insect in her selection of a place of oviposition, but both herself and the larvæ may need protection from natural enemies, and such protection may result from a close resemblance to other protected species, or to inanimate objects, thus deceiving, to a greater or less extent, the natural enemies that threaten their destruction. It often occurs that the form and color of the adult or of the larva is such as to afford protection, but there are many cases, where, without the assuming of certain positions, to represent forms not preyed upon, or inanimate objects, like twigs, lichens or portions of flowers, or where peculiar movements are

necessary to complete the deception, form and color would fall far short of protecting. The point in dispute is as to whether these actions are of volition, and with the anticipation of protection to be derived therefrom, or are they involuntarily, and to be classed with the blushing of a timid maiden when becoming suddenly confused, or the whitening of the face of the less timid, when brought suddenly face to face with what appears certain death? The timid maiden is in no danger, and blushes not because she intended or wished to, but because she had no power to avoid so doing; while the frightened one was in danger, but equally unable to prevent a different change of color in her face, though no protection would result. If, as we suppose, the sense of pain decreases, as we descend in the scale of animal life, than the action that, with form and coloration, tend to deceive the enemy, must be made in order to escape destruction. A recent writer in Natural Science (Vol. IX, p. 299) states that while sitting in a tree, rifle in hand, waiting for a tiger, his attention was caught by a kind of slow cricket, which exactly resembled a small patch of gray lichen, skurrying round the trunk of a neighboring tree, with a lizard in full pursuit. "Just as the lizard came up with it, the cricket, falling in with a slight depression in the bark, stopped dead and flattened itself out, and the lizard was utterly confounded. There it stood, looking ludicrously puzzled at the mysterious disappearance of its prey, which was just under its nose." Here we have a sense of danger, a fear of death, and an attempt to escape death by flight; and when still pursued, certain actions that rendered the peculiar coloration of the insect of greater life-saving value than flight, were employed. With no knowledge of its own resemblance to a patch of lichens, and equally ignorant of the protective value of this resemblance, would the insect not have continued to attempt escape by further flight? How did it know that the pursuer was an enemy? How did it become aware that, to receive the benefit of its appearance, it must stop, when it had before followed the opposite course? If it had no knowledge of its appearance, how would it be able to separate one of the opposite sex from a patch of lichen? Without such a knowledge how can there be sexual selection at all?

Under the head of "A Case of Mimicry," Prof. Otto Lugger, in Entomological News, Vol. VI, pp. 138-140, gives a quite similar case of protective mimicry, as observed by him in *Marmopteryx gibbicostata* Walk. Professor Lugger saw on an elm tree what appeared to be the remains of a moth that had apparently been left over from the dinner of a spider, and, recognizing it as new to his collection, like every

other entomologist, preferring a poor specimen to none, attempted to secure it, when he was astonished to see his treasure take wing and disappear. Returning again to the same tree an hour later, he observed a second specimen, or perhaps the same one in the same position, but this took wing and disappeared. Returning again next day, he began to brush the trunk of the tree with a small limb, as is usually done in flushing *Catocala*. Finally, a moth alighted within two feet of him, ran rapidly a few inches and disappeared. It was then that the observer saw that the moth, after reaching the tree, would run to some projecting piece of bark that had a certain gray color so common upon old elm trees, then make a quarter turn, and fold its wings in a peculiar way upon the spot selected, that blended so well with it as to become invisible. In the normal position of these moths when at rest the color of the upper surface of the wings would contract with the color of the surface on which it was resting; as only the color and markings of the under side of the lower wing, and a narrow margin of the upper edge of the under side of upper wing, harmonize with the grayish spots before mentioned, and therefore these last must be displayed and the others hidden. The moth by making a quarter turn, and by pushing the upper wings deeply between the lower ones, effectually hides all colors not in harmony with its surroundings. As the colors upon the exposed parts vary somewhat from a very pale to dark, the insect, in order to render the deception complete, must select a spot of the proper shade to correspond; yet Prof. Lugger states that of the hundreds of moths he saw, none could be detected upon the trees unless the spot upon which they were observed to settle was kept carefully in sight until they were approached closely. In this case the deception was more largely a matter of action than of coloration, and the action would certainly imply a knowledge of not only the colors of its own wings but of its surroundings also. Collectors of *Catocala* are familiar with similar phenomena among that group of moths, as a scar or slight blaze, such as is often made by woodmen to mark paths or boundaries, are more often selected for resting places than other parts of the trees.

In North American Entomologist, Vol. I, p. 30, Dr. D. S. Kellicott has called attention to the fact that the moth *Alaria florida* Guen., conceals itself during the day in the withering blossoms of the Evening Primrose, *Œnothera biennis*. The inner two-thirds of the fore wings of this moth are bright pink, while the outer third, hind wings and abdomen, are pale yellow. The moth enters the flower before day,

with its body resting upon the style, the four-parted stigma projecting beyond the tip of the abdomen, appearing like a part thereof, and when the sun appears the two petals that were above the moth soon wilt and fall down over the roof-like wings, concealing the hinder portion, leaving the yellow part exposed as a part of the blossom, and so effectually is the moth concealed in this way during the day, that only a trained eye can detect its presence, and even then with extreme difficulty.

Some time after Dr. Kellicott had published his observations, and before I knew of them, I find, from looking over some old note books where I had recorded observations made in Illinois, that a specimen of this moth was taken by myself under much the same circumstances, except in this case the pink color was exposed from under a reddening, discolored leaf of Evening Primrose, in such a manner that the *yellow* was concealed and the deception was so marked that I made a record of it at the time. I still have the moth in my possession, and I have never taken a specimen except on this plant, and concealed in the manner indicated by the observations of Dr. Kellicott and myself.

In "A Naturalist in the Transvaal," pp. 41, 42, Mr. W. L. Distant calls attention to the fact that while a butterfly, *Hamanumida dædalus*, in Senegambia, Calabar and the Cameroons, according to report, always settles with the wings vertically closed, and which so closely resemble the soil of the district, that it can with difficulty be seen, the color varies with the soil in different localities, yet in the Transvaal, and Natal, he was never able to observe it to rest except with horizontally-expanded wings, by which its protection was almost equally insured, by the assimulative color of the same to the rocks and paths on which it was usually found. Here we have an insect breaking away, or at any rate differing radically from a prevailing habit, where such habit would tend to expose it to natural enemies, and following that habit where it derives protection therefrom.*

In the case of *Podosesia syringæ*, which when in flight the abdomen has almost the exact position of *Polistes annularis*, when it is at rest, the posterior segments are bent downward and kept in motion, and if

* While quite foreign to this particular point, it is interesting to note the difference in the action of our domestic sheep, in different parts of the country, on the appearance of sudden danger, like a wolf or dog. In the eastern and central-western states, a flock will break and run for a place of safety, and if still followed will scatter, each individual for itself. But in the far West, on the appearance of a like danger, the sheep will run directly to a common centre, and arranging themselves in a circle, heads outward, await further movements of the enemy.

it falls to the ground it will walk about precisely like the wasp it seems to resemble the most closely, so that its actions constitute by far the greater portion of the mimicry, and therefore are to the greatest extent protective in effects.

Among those species which resemble ants the most closely, and appear to derive protection therefrom, we find that, besides a more or less close resemblance in form and color, they have the erratic, rapid movements of such species of ants as they most resemble. *Pilophorus bifasciatus* Fab., a species of Hemiptera which is here in Ohio frequently associated with a species of black ant that is common and very often observed running up and down the trunks of trees and out on the limbs and twigs, does not closely resemble one of these ants when pinned and placed in the cabinet of a collector; but when running about over the trees they have the quick, erratic movements of the ants, and are then very difficult to distinguish from their associates.* In this case the deception is largely due to movement, and but for this there would be little resemblance. Belt, in "The Naturalist in Nicaragua," p. 314, speaks of a species of spider that appeared so exactly like a species of stinging ant that he did not distinguish the difference until he had killed the spider, and adds that "the resemblance is greatly increased by the spider holding up its two fore legs, like antennæ, and moving them about just like an ant."

Not over a couple of hundred yards from where I am now standing I was some years ago collecting small insects from the leaves of an elm tree, and saw what at a glance I took to be the excreta of a bird on the upper surface of a leaf, and, avoiding it, was busily engaged with my collecting. On making a sudden thrust I brought my hand in direct contact with the leaf, and not perceiving any excreta on my hand looked for an explanation, when, to my utter astonishment, the larger portion of the supposed excreta was observed to take legs and run across the leaf, and I found that it was nothing more or less than a small spider, whose back was clouded with a blackish area, surrounded with white. A white splotch remaining on the leaf proved to be only an irregular sheet of spider web, but almost exactly counterfeiting the appearance of semi-liquid bird excreta that had become dried, and I saw at once through the whole deception. Taken separately, the spider was easily recognized, but placed on its sheet of thin white web and the deception was

* In this case the rays of light reflected from the polished, black surface of the abdomen of the ant, appear like a transverse whitish band, very like in appearance to the transverse white fascæ on the wings of the bug.

complete, and I have no doubt but that it not only escaped its enemies, but secured a better supply of food in consequence of its concealment, though in plain light, in a most exposed position. Mr. Henry O. Forbes, in his "A Naturalist's Wanderings in the Eastern Archipelago," p. 63, gives a similar experience of his in Java. In this case the observer saw what he supposed to be a butterfly at rest on a splotch of bird excreta on a leaf. Mr. Forbes carefully approached his prize until he was able to seize it between his fingers, when, to his astonishment, the wings parted from the body, which was left behind, and he still thought it had adhered to a small splotch of bird excreta until he touched the latter with his finger to find if it was glutinous, when, to his delighted astonishment, he found that the supposed excreta was really a peculiarly colored spider lying on its back, with its feet crossed, and on an irregularly shaped film of web, appearing like a splotch of excreta, with its central and denser portion of a pure chalk-like color, streaked here and there with black, the white margin being drawn out into a narrow streak, with a slight thickening at termination near the margin of the leaf. Two years after, in Sumatra, Mr. Forbes, while waiting for his servants to procure some botanical specimens for him, rather dreamily plucked what appeared to be an excreta-marked leaf, and, while looking at it, mentally wondered why it was that he had never found a second specimen of the curious spider found in Java, when suddenly the supposed excreta bit him, and he was astounded to learn that he actually had a second specimen in his hand (loc. cit., p. 216).

In transmitting his specimens to Rev. O. P. Cambridge, for determination, Mr. Forbes used this expression: "the similitude is so exact that the spider might have had consciousness, and it could not have been more exact if the spider did have it," referring, of course, to the placing of itself on its sheet of web and the deceptive resemblance previously mentioned, though he really had no intention of crediting the spider with any conscious design, as Rev. O. P. Cambridge at first supposed. The latter gentleman, however, offered the following explanation of the phenomenon (loc. cit., pp. 119–121): "It seems to me, on the contrary, that the whole is easily explained by the operation of natural selection, without supposing consciousness in the spider in any part of the process. The web on the surface of the leaf is evidently, so far as the spider has any design or consciousness in the matter, spun simply to secure itself in the proper position to await and seize its prey. The silk, which by its fineness, whiteness and close adhesion to the leaf causes it to resemble the more fluid parts of the excreta, would gradually attain

those qualities by natural selection, just as the spider itself would gradually, and probably *pari passu*, become, under the influence of the same law, and more and more like the solid portion." And further, in a foot note on p. 121: "Is not this exactness probably the result of the unconsciousness of the spider? Conscious-design would possibly have resulted in a failure and abandoning the plan, or at least in a more clumsy imitation." *

To a great many naturalists it would appear as though if consciousness were present at all it would first exhibit itself in protecting life and afterwards in sustaining it. Without life food would be unnecessary, and the same consciousness that would lead the spider to take certain precautions to sustain life would impel it to take other or, perhaps, the same precautions to protect its life. The earlier attempts might be crude, but so long as they obscured the spider from the equally crude vision of either foe or victim, it would suffice. Of course, if it should be found that these species of spiders are inedible, then the whole effect of the deception would be to aid in sustaining life, but this is yet to be shown. Besides, it does not appear impossible that a kind of obscure and limited consciousness may have developed, springing, perhaps, from inherited instincts sufficient to enable these spiders and various species of insects to take advantage of action or movements, in order to protect their lives and perpetuate their species, but not extending beyond this point in development.

When, in the earliest development of animal life on the globe, one form or individual began to prey upon another, then self-preservation became necessary, and death a catastrophe to be feared and avoided. We would, here, have the first fear-incited efforts put forth to escape destruction by flight—the first impulse that seizes even man at the present day, when suddenly exposed to impending danger. The next effort, usually put forth by an organism, is to hide or secrete itself from a danger that, perhaps, cannot be avoided by flight. The second of these efforts, it is possible, might have followed the first very rapidly in time of development, and, later on, as the struggle for life became more severe between different forms, concealment for the purpose of surprising and capturing prey might have developed, and still later, the attempt at defense on the part of the form pursued, would lead to trials of strength between the attacking organism and the organism attacked,

*These isolated observations give us no data whereby to judge to what extent individual spiders vary from each other in their architecture, or to what extent, if any, the young profits by imitating its parents.

but the object of all of these efforts would be the protection of life, by escaping capture and securing food to sustain that life, and the most successful would be the most apt to survive.

But have we not had, during all of this time, a consciousness of possible destruction and volition in the efforts put forth to get out of the way of an enemy in pursuit? Do not these, in fact, coexist with animation itself; and does not their presence really afford natural selection the primary foundation with which to begin the development of certain characteristics, and perfect such to an extent necessary to the life of an organism?

Another kind of phenomena, commonly termed feigning death, also comes within the scope of this paper, and includes such species as, when they are alarmed, either fall to the ground or assume certain rigid positions while attached to plants, or both, so as to appear either dead or like some lifeless object. Many insects, when disturbed, will draw up their legs and falling down remain perfectly still and rigid until the supposed enemy has passed on. Very many of our beetles do this, and because of our common opossum *Didelphys virginiana*, taking a similar course in its attempts to escape death, the action has been vulgarly termed "playing possum." Species belonging to the Coleopterous genera *Chlamys* and *Exema*, however, are shaped and colored so as to almost exactly represent the excreta of caterpillars, and when feeding, if disturbed, will drop to the ground if not caught by the leaves of the plant upon which they are feeding, and as they lay perfectly still, may be unrecognized by even fairly good entomologists. But, even the peculiar form and color of these insects would fall far short of protecting them while feeding, as their position at that time is so entirely different from that under which the excreta of caterpillars is usually observed; but, when they loose their hold, and drop to the upper surface of a lower leaf and either remain there or roll off and fall upon the ground, the deception is complete.

The resemblance of the larvæ of Geometridæ, to small twigs of trees and shrubs is everywhere observed, and as universally excites feelings of delight and surprise. When disturbed, the caterpillars assume a rigid position, more or less transverse to the limb upon which they are located, so that their position, together with the peculiar form and color of their bodies, render them not easily detected. In some species, the form of the body is such as to closely resemble a dead twig, even to the buds thereon. In this case it requires the assumption of the peculiar and rigid position, in order to complete the deception so far as it is

complete. On one occasion I found several eggs of a parasitic fly, one of the Tachinæ, placed among the bases of the legs, where the enemy could by no possibility have placed them had the caterpillar not occupied the peculiar position that it assumes when disturbed, thus showing that the deception was not complete.

An interesting point is here brought out, as, if all individuals attacked died, there would be no progeny and, therefore, no transmission of acquired life preserving consciousness, this could only be brought about by individuals that were attacked and escaped death. A new enemy would be more crude and bungling in its work, and thus allow of a greater number of escapes.

Now, in all of these phenomena we have form and color, supplemented by action, the object of all of which, taken together, is the protection of life. Indeed, what else have these organisms to protect? And of what service would life be to an organism, without intelligence enough, to, in a measure, enable the possessor thereof to protect that life? In all of these actions and movements, do we not have the same kind of consciousness, intelligence and volition, that we do in the case of a bird building a nest, with the expectations of laying its eggs in that nest and rearing its young? Are not all of these positions assumed, and movements made, with the sole aim of protecting life—continuing to live? Did not life and a life protecting intelligence co-exist, in the beginning, in some primitive organism, and was not this primitive, live-protecting intelligence, developed side by side with form and color, until the present conditions of affairs has been the result? The term "protective mimicry," is misapplied when used to designate this developed condition, because that term implies the personation of different objects, by different individuals of the same species, at the same time and in the same exact locality, which is not the case. But, though the same species may "mimic" different species in different localities, or different sexes may "mimic" different species, or one sex "mimic" and another not, yet these conditions cannot be changed to meet any sudden change of environment. Not only will the forms, colors and colorations continue long after the enemy to be protected from has disappeared, but as Mr. Distant has shown ("A Naturalist in the Transvaal," p. 66,) the "mimicing" form may continue to "mimic," even when the mimiced form has fallen far below it in point of numbers and becomes almost or even quite extinct.

It was Mr. Bates who wrote in his "The Naturalist on the Amazon," that "on the wing of the butterfly is written, as on a tablet, the story

of the modification of the species, so truly do all changes register themselves thereon," and it seems to me that in the brains of so-called "mimicing" species of insects, we might, if we could but understand the full significance of brain cells, read therein the records of the development of a dim, obscure consciousness, a volition and an intelligence that has kept pace with the requirements of these organisms, in protecting their lives and perpetuating their race. Man himself comes into the world, little less than a mere automaton, but with an inherited basis for future development of an individual consciousness. He begins his education with the alphabet, but does not transmit even a knowledge of this alphabet to his offspring, who must begin precisely where he himself began. But there has descended to his children, that which will enable them to master the alphabet with more aptitude and less difficulty. Now, if we descend the line of animal life, until we reach these insects whose movements go far toward perfecting the protection afforded by their form, color and coloration, may we not expect to find the foundation for a "species consciousness" that will enable the possessors to protect their lives from enemies of long standing and gradually, though, perhaps very slowly, adapt themselves to shunning the attacks of more recent foes? Or, to put the question in other words, with a protective appearance, will there not go either a consciousness of that appearance, or an inherited foundation for such a consciousness, that will the better enable an insect to apply its protective inheritance, and in the use of all of these, as a means of perpetuating its kind, follow strictly in the line of all other animal life?

NOTES ON THE TRANSFORMATIONS OF THE HIGHER HYMENOPTERA. II.

By A. S. Packard.

Polistes (probably **P. canadensis** *Linn.*).

Larva.—It differs generically from *Vespa* in its head being about twice as large; the body is much shorter, a third shorter than in Vespa, and more ovoid; the end sharper, the body narrowing rapidly towards the tip, which is more pointed than usual; towards the head it tapers rapidly, the prothoracic segment being small in proportion to the head. The lateral ridge of the body is but slightly prominent. The body is not entirely cylindrical, but very convex above, and flattened beneath. The last sternite is twice as broad as long; the sides of the anal opening

are more exserted and prominent, the last tergite being much more produced than in Vespa. The nervous system is nearly the same in the middle of the body, but owing to the shorter segments the ganglia are nearer together, and each ganglion is opposite each suture; the size of the ganglia and of the cords are the same, but the ganglia appear to be a little farther separated than in *Vespa*, in the specimens examined.

The head is very large, round, short and broad, full, convex above. The eye-slits are long, narrow, oblique and prominent. The antennal tubercles are flat, depressed, large and conspicuous, and are placed on each side of the clypeus and in a line with the anterior or lower end of the eyes. The clypeus is large, very regularly equilaterally triangular, the apex or posterior portion separated by a slight suture from the anterior and much larger portion; the front edge is straight and aligned with the squarely docked front edge of the side of the head. Labrum very broad and short, nearly as broad as the clypeus is long; the front edge is straight, the sides well rounded; rounded, swollen, full and very prominent at the end. Mandibles broad, triangular, very acutely bidentate, much shorter and broader at base than in the Apidæ, very convex on the outer side. Maxillæ large, full, swollen, with two small corneous tubercles on the interior next the mouth. Very full and bulging externally. Labium well separated from the mentum by a distinct suture, with two terminal tubercles. Mentum broad, low, triangular, not quite reaching to the outer side of the maxillæ, but nearly as broad as the head.

It differs from the larva of *Vespa* in having the antennal tubercle a little more approximate, the clypeus more regularly triangular and more distinct, while the labrum is very much larger and excessively swollen. The mandibles are very different from those of *Vespa*, being bidentate, very acute, broad at base, triangular, while in *Vespa* they are tridentate, oblong, and as wide at the tip as at the base, the teeth being rather equal and blunt, while the mentum is not prominent. The entire head is freer from the body in *Polistes*, and harder, more corneous than in *Vespa*.

Both *Polistes* and *Vespa* larvæ differ from those of *Bombus* and Apidæ in general in having the clypeus and mouth-parts larger; by the antennal tubercles being more distinct, by the presence of the eye-slit, by the larger mandibles and maxillae, while the entire head is larger in proportion to the rest of the body, and the surface of the segments are smooth. The end of the body is more acute, and the lateral ridge less marked. (In the larva of *Pompilus*, the segments are more thickened

than in *Megachile*.) The sides of the epicranium at the insertion of the jaws in *Vespa* do not bulge out, and become squarely truncated as in *Polistes*.

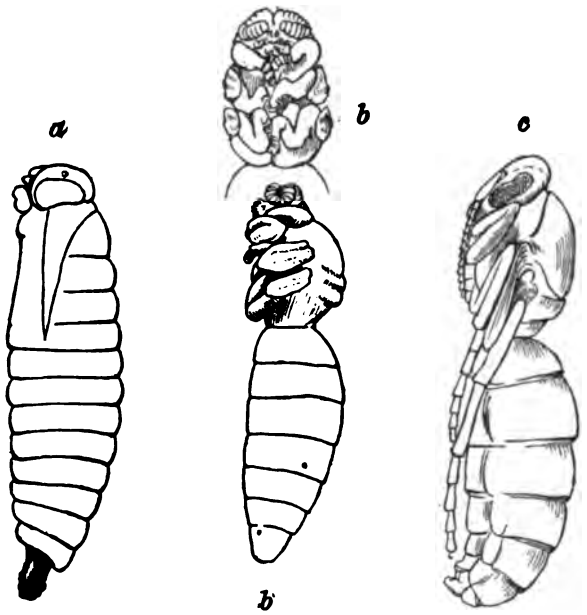

Fig. 6. *Polistes*, *a*, larva beginning to change to pupa; *b*, semipupa; *b'*, ventral view of head and thorax; *c*, pupa, ×3, (Emerton *del.*)

Pupa.—Compared with that of *Vespa maculata* the body is much longer and slenderer and the tubercle on the head is not near so large and prominent. The clypeus is longer and fuller; the labrum is small. The antennæ have the joints half as long, and the appendage, as a whole, is still less bent than in *Vespa*, and much shorter than in *Vespa*, not reaching to the tip of the anterior legs. The trochanters are very much larger than in *Vespa* and at least twice as long. The maxillæ are much shorter than in *Vespa*, the lingua not so deeply bifid. The legs are much longer than in *Vespa* and the wings do not reach so near the tibial spurs as in *Vespa*, while the hind legs nearly reach to the tip of the abdomen. Seen sideways, the legs and wings, especially, are much more oblique and parallel to the longer axis of the body than in *Vespa*. The thorax and long narrow subpedicellate abdomen are much as in the imago. The ovipositor is still exserted, while the last tergite is greatly

expanded, forming an irregularly hexagonal expansion, the end of which is broad and square, with the edge excavated.

Vespa (probably **V. arenaria** *Fabr.*).

Larva.—The head is about as long as broad, the vertex very slightly depressed in the mesial line. Eyes well marked by a long narrow testaceous line. Antennæ rather remote from the sides of the clypeus, when compared with those of *Polistes;* the round flattened antennal area, situated within an ovate much larger area, is obsolete in *Polistes*. The clypeus is much longer and narrower than in *Polistes*, extending farther back towards the vertex; the posterior portion not being so clearly divided from the anterior part as in *Polistes*. It is a quarter longer than wide, and it differs very much from *Polistes* by its front edge contracting and narrowing towards the labrum, where in *Polistes* it rather spreads, so that the labrum is much narrower, being less swollen, nd shows a tendency to become bilobate. Mandibles stout, thick, oblong, bidentate, the teeth small, cylindrical, not nearly so sharp as usual. The maxillæ are 2-tuberculate, swollen externally. The labrum is distinct from the mentum, with two terminal tubercles, and a terminal testaceous line, probably the lingua.

The body is long, cylindrical, not curved on itself so much as in *Polistes* owing to its posture in the broad cell, which is longer and narrower than that of *Polistes*. Posteriorly each segment is somewhat thickened, as are the pleural ridges. The end of the abdomen is rather blank, the last sternite large and transverse, while the tergite is considerably smaller than in *Polistes*. The elements of the ovipositor are distinct, two rather remote tubercles visible on the 8th abdominal segment, and 4 arranged in a semicircle on the 9th, the two inner ones much larger than the minute outer pair. Above, owing to the thinness of the pellicle along the median line of the body, the dorsal vessel can be distinctly seen in the alcoholic specimens; each section of the vessel dilating probably near the posterior edge of each segment where the valves are probably situated and dilating not angularly so to speak from the insertion of the succeeding section.

Halictus parallelus *Say* and **H. ligatus** *Say*.

Larva.—Body very slender, cylindrical, quite different from the broad flattened body of *Andrena;* it is rather obtuse behind, but in front tapering slowly towards the head, which is of moderate size, and of the width of the prothoracic segment. The thoracic segments are a little tuberculated on each side; they are much more convex than the

abdominal segments which are nearly smooth and very round. The specimen described was not fully grown and was found by Mr. J. H. Emerton, August 13, with eggs of the second brood.

When the larva has voided all its excrement the tubercles over the whole body become very prominent, extending from low down on the side of the body, forming high, regular, very prominent transverse ridges, which beneath the abdomen are more prominent than on the inside of the thorax. Length, .40 inch.

In examining the larvæ of *H. parallelus* and *H. ligatus* the head only differs, so far as one can tell, by the sides of one species bulging out; in the mandibles of *H. ligatus* being longer and slenderer, and the notch below being longer and ending in a distinct seta. The head in the two species is of about the same size; the clypeus is of the same shape, the head above being a little more divided in *H. parallelus* than in *H. ligatus*. The entire larva of *H. ligatus* is much longer and slenderer than that of *H. parallelus*, and the thickened tuberculous portion of the segments inclined to be a little more prominent. These differences are sufficient to produce changes in form, rendering the identification of the larva easy, but the best specific characters are the differences in size and slenderness of form. The larvæ being just in the period approaching the semi-pupa stage, the head is protruded and the segments more or less elongated, as the parts of the pupa growing beneath press out the larval skin in various directions. The ovipositor can not be detected beneath the thin larval skin.

This larva (the following description applies to it when in the early semi-pupa stage, and there are no hairs yet developed) differs from that of *Andrena vicina* in being longer and slenderer in proportion. The antennae are shorter, stouter and more clavate. The mandibles in this stage are not corneous. The maxillæ are shorter, the lingua much longer than the tips of both pairs of palpi, which are of the same length as in *Andrena*. The two tubercles behind the ocelli are unusually prominent. Of the three ocelli, which are arranged at points in an equilateral triangle, afterwards becoming a very slight curved line, the middle one in front is not raised.

In front of the ocelli, arranged transversely in a slight curved line, are four low, flat tubercles which resemble the ocelli; these disappear when the pupa becomes mature. The head and front, including the clypeus and labrum, are as in *Andrena*, but the supra-clypeal region in the specimen before me is better marked. The legs are a very little slenderer, and the hind tarsi do not reach nearly to the tip, but only half way, as the abdomen is much less elongated than in *Andrena*.

The thorax is very convex, there are two high prominent tubercles on the scutellum, which are higher and longer than in *Andrena*, also two smaller ones on the meta-scutellum (none on the port-scutellum). The propodeum is more like an abdominal segment than a thoracic one; it is broad and square-cornered, twice as broad as long, not yet separated from the abdomen. The latter is now one-half larger than the head and thorax. The segments posteriorly are very convex, and the edges very distinctly, thickly and finely dentate; the end or terminal segment of the abdomen is long and slender.

The presence of the four deciduous semi-pupal tubercles on the head, which in this stage are so large and distinct, and which are arranged in a transverse line just in front of the ocelli, is interesting and deserves further investigation, as their use is unknown. The fact that all these tubercles disappear afterwards is of additional interest, also the circumstance that they do not exist at all in the corresponding stages of *Apis* and of *Bombus* is perhaps a characteristic of that sub-family of Apidæ (*Andrenetæ*) of which *Halictus* is a member.

The pair of tubercles on the meso-scutellum and meta-scutellum are also of corresponding interest. They are scarcely homologous in position with those of *Oxybelus*, except those on the meta-scutellum. The serrate, very convex abdominal segments are noteworthy, as being a "low" feature. Also noticeable are the great differences between the two high posterior tubercles on the sides of which are situated the two posterior ocelli, so different from the anterior sunken ocellus.

Andrena vicina *Smith.*

Larva.—In *Andrena vicina* the larva is not only much larger, stouter and thicker than that of *Halictus* (*H. parallelus and ligatus*), and not so long in proportion, but the thickened tuberculous portion of the segments is broader, and not so sharply ridged. The two tubercles on the head are more prominent. The clypeus is wider and squarer, and the entire clypeal region broader; the mandibles are stouter and blunter, as are the maxillæ; the best characters are the stouter, more truncate mandibles, and the more raised tubercles on the vertex.

Head with the vertex rather deeply impressed by the median line; on each side is a high, prominent, acute tubercle. The lateral region on each side of the depressed median portion bulging, convex. This median region is divided into two slightly convex pieces. The clypeus is divided into an anterior and a posterior portion. The labrum is nearly square, quite distinct from the clypeus; the edge is square, the sides narrowing very slightly towards the front edge. On each side of the front edge of

the clypeus is a dark, corneous, minute, stout, acute spine. (The use of this process is unknown; it is not present in the larva of Sphex, and is an interesting larval structure.) The mandibles are long, narrow, incurved, the tip very acute and rather long. The maxillæ are cylindrical, stout, short and thick, obtuse, ending in a corneous, black, low, obtuse tip. The labium is short, divided a little at the end, and in the middle into two short, obtuse tubercles.

Compared with the larva of *Bombus* the vertex is not so rounded and smooth, while the lateral eye-pieces are remote and more bulging in front, leaving a broad, depressed mesial interspace; the distinction so marked in Bombus between the clypeus and labrum is in *Andrena* almost annulled, the labrum in *Andrena* being at first easily mistaken for an anterior portion of the clypeus, until after comparison has been made; its edge differs from that of *Bombus* and most other hymenopterous larvæ in being square, entire and much longer, while the trophi, *i. e.*, the maxillæ and labium, are in *Andrena* a little shorter, less produced beyond the mandibles and labrum. In *Andrena* and *Halictus* the segments are much more convex and angular, more tuberculous, while the last abdominal segment is broader, more transverse than in *Bombus*, where it is orbicular.

Fig. 7. *Andrena vicina*, pupa, enlarged nearly three times. (Emerton *del.*)

Nomada (probably **imbricata** *Smith*).

Larva.—The head is much smaller in proportion to the rest of the body than in *Andrena*, smoother and rounder, somewhat flattened, seen from in front somewhat square, with the angles rounded off; the eye-pieces not full convex as usual, but continuous with the middle of the front, which is not depressed mesially. Two black chitinous tubercles situated rather far apart on each side of the epicranium in a line with the insertion of the mandibles, being much farther apart than the sides

of the clypeus, which is short and narrow, projecting from the epicranium and shorter than the labrum. The latter is squarish, convex and rounded at the end, which is thickened, with the edge entire, and provided with four chitinous acute tubercles, two on the edge and two behind. There is a deep depression or pit between the labrum and the insertion of the mandibles. The latter are short, very stout, thick, conical, suddenly ending in an acute mucronate point or spine; they are short, situated far apart, and in my alcoholic specimen do not meet, only reaching to the sides of the labrum. Maxillæ unusually short, low, obtuse, thick, terminating in two very minute corneous, low, obtuse tubercles. Labium stout, short, thick, obtuse. Body long and slender, the segments very regularly convex, scarcely thickened, more so in the middle of the body than in the prothoracic segment, where it is most marked in *Andrena*; the lateral region distinct, the smaller portions less marked than in the higher genera, an important distinction, especially observable in the lower genera of fossorial Hymenoptera, such as *Sphex*, where there is scarcely any difference in shape between the prothoracic and the abdominal segments. Beneath, the segments are smooth, regularly convex, not thickened. The body is straightened out more than usual, tapers unusually fast towards the end of the abdomen. The last segment is much more rounded, more prominent or exserted, more convex, and free from the rest of the body than usual, even in *Sphex*.

On a part of the head, and on the sides, and vertex, and on the tergum are blackish pigment cells; the thickened tergal portion not ending in spinules as usual. The spiracles are large and more distinct than usual in non-parasitic Apid larvæ.

In all respects the larva of this parasitic genus is lower, more degraded, much less differentiated than in the non-parasitic Apid larvæ; the lateral region is less marked; the tuberculous thickenings nearly obsolete, and the whole body more attenuated, tapering rapidly towards the head and end of the abdomen, and is more cylindrical. The head is rather smaller in proportion than in the non-parasitic Apid larvæ. The very hard chitinous mandibles; the almost obsolete maxillæ, the thickened, rounded, entire labrum, with its 4 tubercles, the minute, faintly marked clypeus, the convex surface of the epicranium, not mesially depressed, with a subtriangular depression such as usually occur in non-parasitic larvæ of this family, are signs of degeneration, or at least of adaptation to its parasitic habits, and slightly reminds us of the head of dipterous larvæ. The absence of spinules on the surface of the tergum is noticeable.

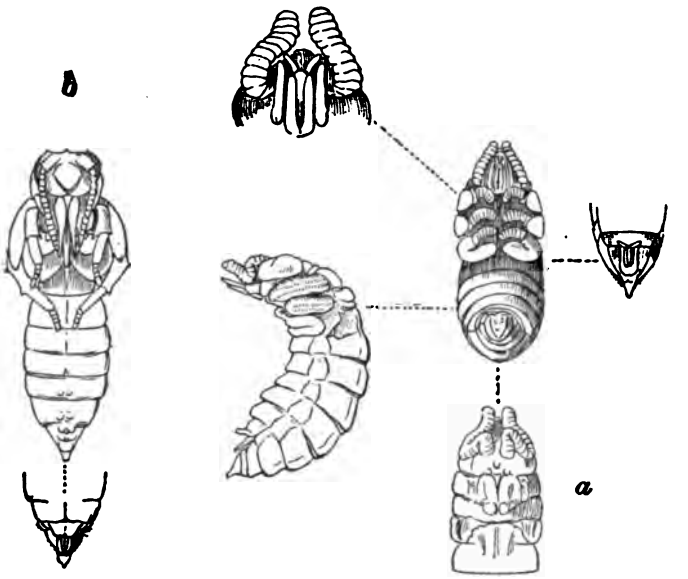

Fig. 8. *Nomada* probably *imbricata*, *a*, semipupa; *b*, pupa. × 3. (Emerton *del.*)

Nomada imbricata *Smith.*

Pupa.—The pupæ of both sexes occurred in the nests of *Andrena vicina.*

♂. Head not so broad as in *Andrena.* Ocelli situated in a curved raised line; on the upper and posterior edge of the orbit are three conspicuous spines, which are not present in the other genera, and are evidently of use in locomotion. Front of the head much narrower and depressed next to the orbits; the insertions of the antennæ are nearer together than in *Andrena.* Supraclypeal piece well marked, though the outlines are as yet indistinct. The clypeus is broad, subtriangular, the surface very convex. Labrum not distinct, separated by suture from the clypeus, somewhat triangular in form, with the front edge well rounded. Mandibles long, cylindrical, regularly incurved; tips unidentate, subacute. Antennæ stout, not clavate, reaching to the insertion of the posterior trochanter, also reaching just to the tips of the maxillary palpi; the joints as long as broad, each with a mesial constriction. From the labrum drops down a long slender pointed tongue-like piece (the epipharynx) into the base of the maxillæ (also present in the pupa of *Bombus*). The lingua reaches beyond the tip of the antennæ; the tip long, slender and pointed. Paraglossæ as long as the part of the

tip of the lingua extending beyond the end of the maxillæ. The 5-jointed labial palpi reach one-half way between the end of the lingua and the end of the maxillæ; the joints of both pairs of palpi rapidly decreasing in size; the maxillary palpi 6-jointed, reaching only to the tip of the maxillæ, thus being much shorter than the labial palpi, whereas in the pupa of *Andrena* they reach to and are parallel with the tips of the other pair. All the mouth parts are twice as long as in *Andrena*, and in this respect *Nomada* seems more allied to *Bombus*, etc., but otherwise, and in its elongated body especially, it is much lower. The legs are slenderer than usual, the tarsi folded on the breast as usual, the hind legs only reaching to the middle of the abdomen, which is unusually long and slender, the segments long, very convex, the sutures large, broad, deeply impressed, the hind edges much thickened, dentate beneath (not so in *Andrena*) showing that the pupa of this parasitic form probably moves about a good deal in its cell. On the hind edge of the 7th and 8th abdominal segments grow out a pair of tubercles, those on the 7th small and simple, the 2d pair (on 8th) very much larger and ending in a nipple-like papilla. The 9th sternite is square and slightly excavated at the edge, while the terminal (probably 10th) tergite is elongated into an acute extensible point tipped with black. These rhabdites agree well in form and position with those of ♂ *Andrena vicina;* they are, however, a little longer, more exserted, and the 10th tergite is longer, slenderer and more pointed.

Thorax: The mesial groove and parapsidal grooves of the mesothorax are deep and better marked than usual. The scutellum rises into two prominent tubercles which are larger than in *Andrena*, while the meta-scutellum is smaller, being small and scarcely tuberculated. The propodium is broad and flattened, contracting somewhat posteriorly. The hind tarsi are spinulated on the outer edge.

♀ differs from ♂ in the head being a little wider and the body thicker; the antennæ are of the length and size in both sexes, though differing in the adult, and the mouth-parts are precisely the same. Tip of the abdomen: ovipositor with three pairs of rhabdites almost entirely exserted; the tip is precisely as described in the ♂, ending in an acute prolonged point, and the square end of the 9th urite forming the under side of the anus is the same as in the ♀. (This identity in the pupa is interesting. The ♂ and ♀ external genitals seem to be strictly homologous in position though the genitals of the ♂ only consist of two pairs of appendages (rhabdites) arising from the 8th segment. The ♂ has one abnormal segment more, this being absorbed in the ♀. In the

abdominal ♂ tip of *Andrena* the 7th urite is rounded, triangular, covering in the two small rhabdites on the 7th segment; those on the 8th are large, smooth, full, simple, not ending in apapilla, as in *Nomada*; the 9th urite is full, not so flat and excavated or as deep as in *Nomada*; the 10th tergite rounder and shorter than in *Nomada*.

LIST OF DRAGONFLIES TAKEN NEAR BUFFALO, N. Y.

By E. P. VAN DUZEE.

During the seasons of 1895 and 1896 I took up the collection of the local Neuropteroid insects as a recreation from the heavier work I had been doing on the Hemiptera. The time at my disposal was very limited, only a few half-days during the summer, therefore it is not likely that this list, which enumerates 41 species, is anything like a fair representation of our local Odonat fauna.

The principal localities mentioned are the following: Squaw Island and Black Rock Harbor, in Niagara River, are within the limits of Buffalo City. Ridgeway, Ont., is on the north shore of Lake Erie, twelve miles west of Buffalo, and Point Abino is just beyond. Between these stations is a large swamp separated from the lakes by sand-dunes, reaching in places a height of 100 feet. About here is by far the best collecting grounds within many miles of Buffalo. Stations at Tonawanda and Amherst are on a deep stagnant creek which affords excellent breeding grounds for many of the Dragonflies. Colden and Boston are 20 miles southeast from Buffalo, among hills about 600 feet in height, where the country is well wooded in places, and traversed by rapid streams. Lancaster, Elma and Hamburgh are on the level country, about 10 miles east and south from Buffalo. Clarence is farther east, and there and at Hamburgh are bog swamps that harbor many Odonata and other insects both interesting and distressing.

Several interesting localities not far from Buffalo have not yet been visited for the Odonata. Among these is Niagara Falls, and it is not improbable that this and other places at Chippewa, the lower end of Grand Island, etc., will yield numbers of fine species not on this list. Two or three species from the upper end of Grand Island taken by Mr. Philip Fischer have been included to make this list more complete.

For the determination of these Dragonflies I am indebted to the kind-

ness of Dr. D. S. Kellicott, and Mr. P. P. Calvert has kindly undertaken to revise the list and publish it in connection with his additions to the list of Dragonflies of New York State:

Calopteryx maculata *Beauv.* This pretty insect makes its home in deep woods and in gullies among the hills where a rift in the foliage admits the sunlight to the little pools that form along the hill-side streamlets. Here they often congregate in great numbers on the bushes overhanging the water. On the level country about Buffalo this species is rarely seen and then only near water in the heaviest woods.

Lestes uncata *Kirby.* June to August. I have taken this species only in boggy woods where the water rarely if ever dries away during the summer. In such situations it flies about the swampy openings where the hot rays of the sun make the mosquitos lively and the collector miserable.

Lestes rectangularis *Say.* Not common. Taken near deep stagnant streams in August and September.

Argia putrida *Hagen.* Through July and August this species is common along some of our smaller creeks where a rapid current is broken by projecting stones. I have never seen it near still water as recorded by Dr. Kellicott.

Argia violacea *Hagen.* Rare. Taken in company with the preceding species in August.

Erythromma conditum *Hagen.* Taken flying over a ditch of running water at Hamburgh, N. Y., in June.

Amphiagrion saucium *Burm.* Common about swampy places through July and August.

Enallagma carunculatum *Morse.* Very abundant from late June to September on Squaw Island in Niagara River and along the shores of Lake Erie where the shallow water is overgrown with reeds.

Enallagma hageni *Walsh.* Squaw Island, June 11th, two examples.

Enallagma exsulans *Hagen.* Taken immature at Black Rock Harbor about June 1st, and mature, in July in a bog swamp at Clarence.

Enallagma signatum *Hagen.* Numbers taken along a sluggish creek north of Williamsville in September.

Ischnura verticalis *Say.* This is the most abundant Agrion about Buffalo. It occurs in immense numbers on Squaw Island and along Niagara River and the shores of Lake Erie where fields of rushes

cover the shallow water. It it also common along all of our inland streams and ponds. Here they have been taken from May to September. The orange females appear to be more abundant than the blue.

Anomalagrion hastatum *Say.* Two males captured among the rushes on the shore of Lake Erie at Point Abino, August 8, 1896. The smallest of these expands but 20 mm.

Gomphus spicatus *Selys.* Taken in a tamarack swamp at Clarence in July, and rarely about Black Rock Harbor, in June.

Gomphus fraternus *Say.* Abundant along Niagara River in June. I have taken it only about still water.

Gomphus villosipes *Selys.* Taken on Grand Island, in Niagara River, by Mr. Philip Fischer, of this city.

Epiæschna heros *Fab.* Common. June and July. I can verify Dr. Kellicott's remark that this species seems to enter our houses from choice.

Boyeria (formerly **Fonscolombia**) **vinosa** *Say.* One example of this interesting species was taken by me from a bush in deep woods far up on a hillside at Colden, N. Y., August 11th, 1896. A little water run was near, represented then by an occasional pool, and here may have been the home of the larva.

Aeschna constricta *Say.* August and September. Taken immature in July. I have found this species most commonly in hilly country where a small brook meanders through open woods and pasture lands. In such places it is sometimes abundant. On the level country about Buffalo it is rarely seen.

Anax junius *Drury.* Common everywhere through June and July. I once watched one of these insects pursuing gnats about a spruce tree until it was so dark I could no longer discern him before the fading light in the western sky.

Macromia illinoiensis *Walsh.* Taken by Mr. Philip Fischer on Grand Island. In July, 1895, I saw an example of this species resting on a store window in the heart of the city.

Epicordulia princeps. Common about Black Rock Harbor through June and July.

Tetragoneuria cynosura *Say.* June. With the next.

Tetragoneuria semiaquea *Burm.* Very abundant at Black Rock Harbor during June, 1895. Early in the month they were mostly soft

and immature. But even when fully matured they were sluggish and easy to capture. By the middle of July they had mostly disappeared.

Tetragoneuria spinigera *Selys.* One female taken on the side of a house nearly a mile from the river in May. Dr. Kellicott identified this as *spinigera* with some doubt, but expressed himself as certain that it was distinct from either of the two preceding.

Somatochlora tenebrosa *Say.* One example of this beautiful insect was taken in a tamarack swamp at Clarence, N. Y., July 2, 1895.

Somatochlora linearis *Hagen.* Taken on Grand Island by Mr. Philip Fischer.

Tramea lacerata *Hagen.* One specimen taken in the city far from the water on August 20th.

Libellula basalis *Say.* Common through June and July along Niagara River and Tonawanda Creek, where the water is deep.

Libellula quadrimaculata *Linn.* Numbers seen about a springy spot among the hills in July, 1895. These, though perfectly mature, were of a rich olive brown color, becoming greenish on the mesonotum, and the black basal triangles on the hind wings were conspicuously veined with white. Though differing in some respects from typical examples, Dr. Kellicott pronounces them undoubtedly *quadrimaculata.*

Libellula semifasciata *Burm.* June and July. Rare about Buffalo, but seen in considerable numbers along the railroad ditches at Ridgeway, Ont.

Libellula pulchella *Drury.* June to August. Abundant everywhere but especially about Black Rock Harbor.

Plathemis trimaculata *De Geer.* Common around mill-ponds and stagnant pools everywhere in the country about Buffalo, but rarely seen along Niagara River.

Leucorhinia intacta *Hagen.* Very abundant on the stones and water plants in Niagara River and Black Rock Harbor through June and early July. This species shows much variation in the extent of the yellow markings on the abdomen and of the fulvous shade on the base of the wings. When fully colored it is a most beautiful insect. Back in the country it is rarely seen, only a few individuals find their home along deep sluggish streams.

Diplax rubicundula *Say.* Common from July to September. The immature taken in June.

Diplax obtrusa *Hagen.* Clarence, N. Y., July 2d; Elma, N. Y., September 15th and Ridgeway, Ont., August 10th.

Diplax costifera *Hagen.* Common along a dusty roadway near a mill pond, in the town of Amherst, September 2, 1895. Not seen elsewhere.

Diplax vicina *Hagen.* This species with *rubicundula* and *obstrusa* occur together in low, wet meadows and along small streams, but *rubicundula* is here much the most abundant form. I have also taken *vicina* among the reeds on the shores of Lake Erie, at Point Abino.

Diplax corrupta *Hagen.* The immature of this large species were abundant on reedy shores of Lake Erie, at Point Abino, on August 31, 1896. In this state their rich fulvous color varied with black and pale green, and their glossy golden wings spread out to the sunlight, made them beautiful objects. When mature the colors become obscured and the insect is much less attractive.

Mesothemis simplicicollis *Say.* Quite abundant along Tonawanda Creek, August 12, 1896. Here the females were depositing their eggs on the confervæ near the shore. In doing this they hovered a few inches above the water, dipping to the surface at intervals of a few seconds with a rhythmic vibratory motion, each time bringing the tip of the abdomen in contact with the aquatic weeds that were to serve as a nidus for their eggs.

Pachydiplax longipennis *Burm.* Rare. A few examples were found in June, 1895, about the Sagittaria in Black Rock Harbor.

ADDITIONS TO THE ODONATA OF NEW YORK STATE.

BY PHILIP P. CALVERT, Philadelphia, Pa.

In this JOURNAL for March, 1895 (Vol. III, No. 1, pp. 39–48) I published a list, with notes, of all the species of Odonata known to me to inhabit New York State. Soon after, Dr. Lintner sent me notes on the Odonata in the State Collection at Albany, including many made by Dr. Hagen, and also a considerable number of unidentified dragonflies for determination. This material and the results of its study have been referred to by Dr. Lintner in his recently published Eleventh Report as State Entomologist, for 1895, p. 105, and are here marked (L.). Professor Kellicott has kindly sent me a few notes which are designated

(K.). References are made to the paper by Mr. Van Duzee, in this number of the JOURNAL on the dragonflies of Buffalo (VD.). The original list embraced 85 species; we now know 102 species and varieties as found in this State.

A. ADDITIONAL NOTES ON SPECIES PREVIOUSLY LISTED.

SUBFAMILY CALOPTERYGINÆ.

1. **Calopteryx maculata** *Beauvois*. Schenectady, July 14, 1875; July 12, 1877; common at Le Grange's Mills, Guilderland, Albany Co., June 24, 1893 (L.). Buffalo (VD.).

5. **Hetærina americana** *Fabr.* Albany Co. (L.).

SUBFAMILY AGRIONINÆ.

9. **Lestes uncata** *Kirby*. Buffalo (VD.).

11. **Lestes forcipata** *Rambur*. Schoharie (L.).

12. **Lestes rectangularis** *Say*. New Baltimore, Schoharie (L.). Buffalo (VD.).

13. **Argia putrida** *Hagen*. Schoharie (L.). Buffalo (VD.).

14. **Argia violacea** *Hagen*. Buffalo (VD.).

16. **Erythromma conditum** *Hagen*. Hamburgh (VD.).

18. **Amphiagrion saucium** *Burm.* Centre, now Karner (L.), Buffalo (VD.).

20. **Enallagma civile** *Hagen*. "New York," Hagen, 1861. The specimens from Saratoga Lake cited in my previous list belong to no. 21.

21. **Enallagma carunculatum** *Morse*, instead of "*Enallagma*; sp. n." In addition to the Saratoga Lake specimens mentioned under no. 20—Three males, one female, Lake Pleasant, July 29, 1887; one male, Piseco Lake, August 29, 1888 (L.). (P. P. Calvert det.). Niagara, etc. (VD.).

22. **Enallagma ebrium** *Hagen*. Schoharie (L.).

23. **Enallagma hageni** *Walsh*. Lake Bluff at Huron; Lake Pleasant, July 10, 1887; Albany, July 6 (P. P. Calvert det.) (L.) Squaw Is. (VD.).

27. **Enallagma exsulans** *Hagen*. Black Rock, etc. (VD.).

28. **Enallagma signatum** *Hagen*. Williamsville (VD.).

29. **Ischnura verticalis** *Say*. Schoharie (L.). Annandale, June 19th, by Mrs. C. W. Throop; recorded by Dr. Lintner, 11th Rep. State Ent. N. Y., p. 288. Buffalo (VD.).

SUBFAMILY GOMPHINÆ.

34. **Ophiogomphus rupinsulensis** *Walsh.* Schoharie (L.).

36. **Gomphus brevis** *Hagen.* Schoharie (L.). Dr. Hagen's note on the specimen, according to Dr. Lintner, is "Possibly *G. quadricolor* of Walsh."

38. **Gomphus spicatus** *Selys.* Clarence, etc. (VD.).

39. **Gomphus fraternus** *Say.* Niagara (VD.).

40. **Gomphus adelphus** *Selys.* Kenwood, June 17, 1876 (L.). "Never [*i. e.*, previously?] seen by me; 1 ♂ in Selys' coll. from A. Fitch." Hagen, 1877.

41. **Gomphus villosipes** *Selys.* Grand Is. (VD.).

43. **Dromogomphus spinosus** *Selys.* Karner, Albany Co., June 7, 1870, Hagen det. (L.).

SUBFAMILY ÆSCHNINÆ.

45. **Epiæschna heros** *Fabr.* Albany (L.). Buffalo (VD.).

46. **Boyeria* vinosa** *Say.* Schoharie; one female, Piseco Lake, August 31, 1888, one male, Elk Lake, August 22, 1893 (P. P. Calvert det.) (L.). Colden (VD.).

48. **Æschna juncea** *L.* var. **verticalis** *Hag.* Schoharie (L.).

49. **Æschna clepsydra** *Say.* Schoharie (L.).

50. **Æschna constricta** *Say.* Schoharie (L.). Buffalo (VD.).

51. **Anax junius** *Drury.* Schoharie (L.). Buffalo (VD.).

SUBFAMILY CORDULINÆ.

53. **Epicordulia princeps** *Hagen.* Black Rock (VD.). Kenwood (L.). Albany, July 5th, within doors, by Mrs. A. Lansing; recorded by Dr. Lintner 11th Rep. State Ent. N. Y., p. 288.

54. **Tetragoneuria cynosura** *Say.* Black Rock (VD.). Staten Island, June, by Mr. W. T. Davis.

55. **Tetragoneuria semiaquea** *Burm.* Black Rock (VD.).

58. **Somatochlora tenebrosa** *Say.* Oswego Co., Aug. 23–25 (K.). Clarence (VD.).

* Mr. McLachlan has pointed out (Ann. Mag. Nat. Hist. 6, xvii, p. 424, June, 1896,) that the generic name *Fonscolombia*, proposed by de Selys in 1883, was preoccupied by Lichtenstein for Hemiptera in 1877, and consequently suggests *Boyeria* —after Boyer de Fonscolombe—instead.

SUBFAMILY LIBELLULINÆ.

62. **Tramea carolina** *L.* Schoharie (L.)

63. **Tramea lacerata** *Hagen.* Buffalo (VD.).

64. **Libellula basalis** *Say.* Kenwood (L.). Niagara River, etc. (VD.).

69. **Libellula exusta** *Say.* One female, Croton on Hudson, May 17, 1896, by Mr. W. T. Davis.

70. **Libellula quadrimaculata** *L.* Schoharie; Karner, May 28, 1880, (L.). Buffalo (VD.).

71. **Libellula semifasciata** *Burm.* Buffalo (VD.).

72. **Libellula pulchella** *Dru.* Schoharie (L.). Buffalo, etc. (VD.).

73. **Plathemis trimaculata** *DeGeer.* Schoharie, Albany (L.). Buffalo (VD.).

74. **Micrathyria berenice** *Drury.* Sheepshead Bay, Long Island, July, 1889. (P. P. Calvert, det.) (L.).

77. **Celithemis eponina** *Drury.* Lake Bluff, Wayne Co., July 10, 1880 (L.).

78. **Leucorhinia intacta** *Hag.* Centre (now Karner), June 4, 1870, Hagen det (L.). Croton on Hudson, May 17, 1896, by Mr. W. T. Davis. Niagara River, etc. (VD.).

79. **Diplax rubicundula** *Say.* Buffalo (VD.).

81. **Diplax costifera** *Hagen.* Amherst (VD.).

82. **Diplax vicina** *Hagen.* Schoharie, Hagen det.; Piseco Lake, August 31, 1888 (P. P. Calvert det.) (L.) Buffalo, etc. (VD.).

84. **Mesothemis simplicicollis** *Say.* Tonawanda Creek (VD.).

85. **Pachydiplax longipennis** *Burm.* Black Rock (VD.).

B. SPECIES ADDED TO THE PREVIOUS LIST.

SUBFAMILY AGRIONINÆ.

86. **Lestes virgo** *Hagen* (sp. n.) [in MS.]. Lake Bluff, Wayne Co. (L.). (Not seen by the writer.)

87. **Lestes vigilax** *Selys.* "New York" (L.).

88. **Enallagma fischeri** *Kellicott.* Presumably Ithaca, in Cornell University Collection (K.).

89. **Enallagma geminata** *Kellicott.* Parish, August 24 (K.).

SUBFAMILY GOMPHINÆ.

90. **Ophiogomphus mainensis** *Packard.* Schoharie, Hagen 1877; Keene Valley, 1,000 feet elevation, July 6, 1892 (L.).

91. **Gomphus plagiatus** *Selys.* One male, Bethlehem, September, 1880 (P. P. Calvert det.) (L.).

92. **Gomphus amnicola** *Walsh.* Bethlehem; Hagen det. (L.).

93. **Gomphus descriptus** *Banks.* Ithaca, May 21, 1890; May 15, 1894; May 18, 1895. Recorded by Mr. Banks in this JOURNAL iv, p. 195.

SUBFAMILY CORDULEGASTERINÆ.

94. **Cordulegaster erroneus** *Hagen.* Keene Valley, 1895 (L.).

SUBFAMILY ÆSCHNINÆ.

95. **Æschna pentacantha** *Ramb.* Baldwinsville, Onondaga Co., June, by R. H. Pettit; recorded by Mr. Banks in Ent. News vi, p 124.

SUBFAMILY CORDULINÆ.

96. **Macromia illinoiensis** *Walsh.* Grand Is., etc. (VD.).

97. **Somatochlora walshii** *Scudder.* One male, Keene Valley Essex Co., Aug. 5, 1889. (P. P. Calvert det.) (L.).

98. **Somatochlora linearis** *Hagen.* Oswego Co., August 23–25 (K.). Grand Is. (VD.).

99. **Tetragoneuria spinigera** *Selys.* Buffalo (VD.).

SUBFAMILY LIBELLULINÆ.

79*a*. **Diplax rubicundula** *Say* var. **assimilata** *Uhler.* "New York" (L.).

100. **Diplax obtrusa** *Hagen.* Keene Valley, July and August; Piseco and Elk Lakes, August (P. P. Calvert det.); Centre (L.). Recorded from Hastings, Oswego Co., August and September, by Prof. Kellicott in Ent. News, vi, p. 239. Clarence, etc. (VD.).

101. **Diplax corrupta** *Hagen.* One male on the sea-shore near New Brighton, Staten Island, June 27, 1896, by Mr. Wm. T. Davis, and submitted to the writer for examination. Mr. Davis recorded that the frons, base of the wings and abdomen were scarlet in life. Compare also Mr. Van Duzee's paper. This is a common western species which perhaps is extending its distribution eastward. See also Trans. Am. Ent. Soc., xx, p. 264.

Dr. Lintner also mentions four species of Agrioninæ, indicated as new by Dr. Hagen, but these the writer has not seen.

GLUPHISIA SEVERA IN NEW JERSEY.

BY HARRISON G. DYAR.

Fourteen larvæ of this species were collected by Mr. Beutenmüller and the writer at Fort Lee, N. J., in May, 1896. The larvæ pupated early in Juns; imago in April, 1897, of the form *avimacula* Hudson. The food-plant was *Populus grandidentata*. Stages IV. and V. were observed, differing in no respect from Californian examples (see Dr. Packard's monograph, p. 98) eggs were obtained from a bred ♀. They correspond exactly with my description except that there is no black spot at the micropyle. This spot in the Californian egg was probably unnatural. The reticulation of the eggs are very small and rather obscure. This species is probably not particularly rare, but escapes observation on account of the unusually early date of appearance.

A NEW ALEURODES ON RUBUS FROM FLORIDA.

BY T. D. A. COCKERELL.

Aleurodes ruborum, sp. nov.

♀. Very minute, about or hardly 1 mm. long; body and legs pale lemon yellow; wings pure white, spotless. The main nervure appears to fork as in *Aleurodicus*, but only the lower branch is a real nervure, the nervure bending at the apparent fork, which is only a little more than half way from the base of the wing; the apparent upper fork is simply a fold. The second nervure arises from the main nervure nearly at the base of the wing. The margins of the wings, after maceration in caustic soda, appear delicately beaded. Eyes not completely divided. Antennæ 7-jointed, second joint excessively stout, its breadth at top, which is obliquely truncate, being at least as great as that of basal portion of femur. Third joint long, cylindrical, coarsely ringed throughout; fourth short and oval, broader than third; fifth narrow, cylindrical, a little longer than fourth, and very much narrower; sixth cylindrical, almost or quite as long as 4+5; seventh shorter than sixth, but longer than fifth; third about as long as 4+5+6. Anterior tibia very slender, its distal end swollen. Middle and hind tibia not nearly twice as long as their tarsi. Genitalia ordinary.

Pupa: About ⅓ mm. long, oval, flat, delicately transversely ribbed, with a delicate fringe of long, glossy rods, easily broken off; the longest of these rods may be almost or quite as long as the breadth of the pupa. Color of pupa black; by transmitted light after boiling in caustic soda extremely dark vandyke brown. Margin presenting at intervals round, clear orifices, about 14 on each side. Vasiform orifice an elongate triangle, the base about two-thirds the length of a side; operculum heart-shaped, or approximately so, with the corners rounded and the base about as long as a side; lingua projecting only a little beyond, the projecting portion semilunar in outline, showing some tendency to crenulation, after the manner of *A. erigerontis*.

Habitat: Pupæ abundant on under sides of leaves of a cultivated *Rubus* at Lake City, Florida, sent by Mr. A. L. Quaintance. Imago emerging at the middle of February. As this occurred on a cultivated *Rubus*, Mr. Quaintance thought it barely possible it might be an introduced species, but it is probably native in Florida. It certainly is not the European *A. rubi* Signoret, which is more or less marked with black, and has black legs and spotted wings. More nearly it resembles the English species *A. rubicola* Douglas, 1891, which has a yellow body and immaculate white wings; but in *rubicola* the pupa is not black, there is not the fringe of our species, the lingua projects much more beyond the operculum, and there are decided differences in the legs and antennæ of the imago.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF JUNE 16, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Ten members present.

The evening was devoted to a discussion of the best methods of mounting and preparing of insects.

The Treasurer reported the balance of the JOURNAL fund as $368.06 and the Society fund as $133.73.

Mr. Beutenmüller read a notice from the Philadelphia Society about the 4th, of July excursion.

MEETING OF SEPTEMBER 15, 1896.

Held at the American Museum of Natural History.

Mr. Beutenmüller was elected temporary chairman. Nine members present.

The Treasurer reported on the funds of the Society.

The Executive Committee was instructed to organize, and devise ways and means to increase the membership and to invest the money of the Society.

The following resignations were reported and accepted: H. Aich, D. H. Ray, G. D. Hulst, A. Smith.

Col. Nicolas Pike was proposed as an active member by Mr. Beutenmüller. A number of rare coleoptera were exhibited by Messrs. Schaeffer, Meitzen and Joutel and after discussion the meeting adjourned.

MEETING OF OCTOBER 6, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Seventeen members present. Visitors: Dr. George H. Horn, of Philadelphia, and Mr. Blackburn.

Treasurer reported a bill of $24.00 from the Scientific Alliance as the Society's share of the expenses for the year.

The Executive Committee reported that card-cases to contain cards giving the meeting days and other information of the Society be placed at the Museum and other similar places, and that the moneys of the Society be deposited in the name of the Society.

Dr. Ottolenqui moved that the publication committee publish a new list of Lepidoptera, with Dr. Dyar as editor. After discussion the motion was lost, owing to the want of funds.

Mr. Blackburn was proposed as active member by Mr. Beutenmüller.

Mr. Palm spoke of the Coleoptera collected by Mr. Kunze in Arizona, in which he said that *Plusiotis lecontei* was found in the sawdust of old saw-mills, and that *Dynastes grantii* was found in numbers in the tops of ash trees.

Mr. Joutel exhibited the flowers of the cruel-plant with insects hanging from them, and he explained the manner in which the insects were caught by the flowers.

Dr. Horn gave an informal talk about the region gone over by Mr. Kunze and also about Coleoptera generally. The meeting then adjourned.

MEETING OF OCTOBER 20, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Twelve members present.

Colonel Nicholas Pike and Mr. C. V. Blackburn were elected as active members.

Dr. H. G. Dyar spoke on the first larval stage of the Eucleidæ (Limacodidæ). This stage was discribed of ten different species inhabiting New York, and the relations of the species to each other were shown. The results confirm the position assigned to the family on larval characters derived from the adult larvæ, leading back to an ancestral form from which the whole group may have been derived. It appears that this ancestral form must have been more like *Lagoa* than any other known larva, a conclusion entirely in harmony with the author's previous results.

Mr. Joutel gave a few additional notes on the cruel-plant (*Physianthus albens*). After discussion of both subjects the meeting adjourned.

MEETING OF NOVEMBER 17, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Ten members present.

Dr. Seifert spoke of the experiments he was making with the larvæ, pupæ and eggs of moths and butterflies with a view of finding the effects of heat and cold on them. The results were very marked, as shown by the dark forms of *Arctia arge*, produced by cold and the light ones by heat, when placed near a series of normal specimens. Many of the pupæ, eggs and larvæ were kept in 120° Fahr. for 100 hours, others were frozen. He found that the eggs of some species slowly developed in a freezing temperature.

President Zabriskie exhibited several crickets from Florida.

Mr. Beutenmüller gave an account of the capture of the dog's-head butterfly on Staten Island by Mr. Wm. T. Davis. He also said that it was probable that the larva of *Everyx versicolor* spun a slight cocoon and pupated in the branches of its food plant, which grows in swamps where there is always more or less water on the ground, so that it would be unable to pupate like the others of the genus. After discussion the meeting adjourned.

MEETING OF DECEMBER 1, 1896.

Held at the Amerian Museum of Natural History.

President Zabriskie in the chair. Eighteen members and six visitors present.

Dr. Horn was expected to give a talk on Coleoptera, but was unable to attend on account of sickness. A general discussion of insects took place.

Mr. Beutenmüller gave a preliminary account of some of the insects caught during his trip through North Carolina, among which were *Nomaretus debilis*, *Cychrus andrewsii*, *C. bicarinatus*, *Pterostichus blanchardi* and several species of *Platynus*.

MEETING OF DECEMBER 15, 1896.

Held at the American Museum of Natural History.

Mr. Beutenmüller was elected temporary chairman. Twelve members present.

A letter of regret from Dr. Horn was read explaining his absence at the last meeting.

Messrs. Palm, Groth and Joutel were appointed a committee to nominate officers for 1897.

Mr. Beutenmüller read a paper on "A trip to the land of the sky in Western North Carolina," in which he gave a description of the scenery and people as well as some amusing incidents of travel and spoke of the insects he caught, among which, besides those exhibited at the last meeting, were a host of Hymenoptera, Diptera and Lepidoptera; he also exhibited a number of photographs illustrating the trip.

MEETING OF JANUARY 5, 1897.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Ten members present.

Dr. G. Lagai and Miss Margaret Jaggers were proposed for active membership.

The Nominating Committee reported on officers for 1897: For President, Chas. Palm; Vice-President, E. G. Love; Treasurer, C. F. Groth; Recording Secretary, L. H. Joutel; Corresponding Secretary, H. G. Dyar; Executive Committee: Messrs. J. L. Zabriskie, O. Dietz, E. G. Love, C. F. Groth, H. G. Dyar; Publication Committee: Messrs. E. Daecke, C. Schaeffer, L. H. Joutel, Wm. Beutenmüller.

On motion the Recording Secretary was requested to cast an affirmative ballot, and the candidates were declared elected.

The Treasurer read his annual report, which was referred to the executive committee for auditing and to report to the Socicty thereon.

A vote of thanks was given to the retiring officers.

The advisability of holding an annual exhibition of insecets was discussed and the matter was referred to the Executive Committee for action.

Mr. Beutenmüller called attention to Dr. Packard's work on the monograph of the Notodontidæ, saying that it was one of the best monographs extant and ought to be in the possession of every student of Lepidoptera. A limited number of copies were in the hands of Dr. Packard and to be had for $15 per copy.

MEETING OF JANUARY 19, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Twelve members present.

Dr. G. Lagai and Miss Margaret Jaggers were elected active members.

The resignation of Mr. Birnbaum was read and laid over to next meeting.

The President appointed Messrs. Munch and Schaeffer on the Field Committee and Messrs. Beutenmüller and Love on the Scientific Alliance Committee.

The Committee on Constitution reported on the revised constitution and by-laws, which were adopted and ordered printed.

MEETING OF FEBRUARY 2, 1897

Held at the American Museum of Natural History.

Vice-President Love in the chair. Eleven members present.

The Auction Committee reported that a number of insects had been donated to the society by Messrs. Ottolenqui and Dyar.

It was decided to appoint a committee of three to devise ways and means of increasing the membership of the Society.

Dr. Ottolenqui exhibited a series of *Ecpantheria scribonia* showing the typical form merging into the form *denudata*, and questioned the correctness of the variety, saying it was only a worn specimen. Dr. Dyar replied by saying that in the true *denudata* the scales did not hold very well and were sooner lost than in the typical *scribonia*. He also showed a series of *Nadata gibbosa*, in some of which the white in the fringes was entirely absent and in others only represented by one or two white scales, thus agreeing with the description of *doubledayi*, and proving that it was a synonym of *gibbosa*. He mentioned that *Clisiocampa distria* was very common and destructive in New Hampshire the past summer.

Dr. Dyar spoke on a winter trip to Miami, Fla. He described the country and mentioned the species of Lepidoptera seen. Insects were not abundant, but two especially interesting Lepidopterous larvæ were found; the first was the larva of the little black Euchromian *Syntomedia minima*, which has only recently been found in Florida. The larvæ occurred sparingly and were observed in all their stages. The larva is red, tufted with dark grey hairs resembling somewhat some of the species of *Euchætes*, but with the warts of an Euchromian, not an Arctian. The second species was discovered on the Mangrove while rowing up the Miami river. It is the larva of *Eupoeya slossoniæ* Pack., a moth whose family position has been in dispute. Dr. Packard described the form as a "new species of Limacodes-like moth," while Dr. Dyar had considered it Megalophygid. The larva proved to be a true Eucleid closely allied to *Phobetron*. Dr. Dyar described its most essential characters, showing that it was in effect a green *Phobetron* on which had been superimposed the special adaptation of our *Sisyrosea textula* (*inornata*).

Mr. Doll showed an example of *Catocala elda* bred from a larva found on Long Island, on silver poplar. He also showed a beautiful aberration of *Anisota stigma* suffused with black, and one of *Melitæa chalcedon*, also a cross evidently between *Limenitis ursula* and *disippus*. He also had several aberrations of *Cecropia*, one of which had the transverse band crowded to the edge of the wings, making a unique insect.

Dr. Seifert exhibited some Lepidoptera showing the effects of heat and cold on eggs and pupæ. The Lunas which he showed had the eggs frozen twenty days. The eggs of *V. antiopa* were kept frozen thirty days, the effect on the imagos was a general loss of brightness in the males and a gain in the females. The October brood were most affected.

MEETING OF FEBRUARY 16, 1897.

Held at the American Museum of Natural History.

Vice-President Love in the chair. Thirteen members present.

The resignation of Dr. Kretz was read and accepted.

The Auction Committee reported that Mrs. Slosson and Mr. Doll had donated a number of insects for the Journal fund, a list of which was read.

Dr. Love appointed Messrs. Beutenmüller, Schaeffer and Joutel as a committee to increase the membership of the Society.

The Publication Committee reported that arrangements were being made to give a series of lectures to the public and asked for a sum of money to defray the expenses; on motion the sum of fifty dollars was set aside for the purpose.

Dr. Love showed specimens of *Phyllotreta armoraciæ*, an imported beetle, and said they were very common in Wisconsin and were doing considerable damage. They were very partial to horse-radish.

Mr. Beutenmüller showed some Papilio chrysalids with the imagos among which were those of *thcas* and *cresphontes*. He pointed out the differences in their shape and characters which proved that they were not varieties, as some authors had claimed, but distinct species. He also pointed out the differences between *P. bairdii*, *asterias* and *oregonia*, stating that *bairdii* was a variety of *oregonia* and not of *asterias*, and also spoke on the relationship between *brevicauda* and *asterias*. The chrysalid of *Ornithoptera*, sp. and *Papilio philenor* were almost identical in shape but differed in size.

Mr. Joutel spoke of the close resemblance of grasshoppers to leaves and showed two remarkable examples from Brazil.

MEETING OF MARCH 2, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Ten members present.

A note from Mr. Morris K. Jessup was read, giving the use of the large lecture hall of the Museum for the Society's lectures.

A letter from the Scientific Alliance asking for nominations by the Society of a person to receive the first grant of the Newberry fund was read. After discussion the Corresponding Secretary was requested to notify the Secretary of the Scientific Alliance that this Society had no candidate to propose.

Mr. Beutenmüller read a paper by Mr. William T. Davis, entitled, Intelligence Shown by Caterpillars in Placing Their Cocoons (see antea, p. 42).

In a discussion by the members the opinion was expressed that the cases cited were accidental and were not a sign of intelligence.

Mr. J. Doll showed a series of *Pseudohazis* in which the variation was well shown, it being impossible to tell where one species finished and the other began, the differences being evidently only local variations.

MEETING OF MARCH 16. 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Eleven members present.

The following resolutions were adopted:

WHEREAS, The present rate of postage on specimens of natural history to foreign countries being the same as letter rates, a burden some and excessive rate, and

WHEREAS, An amendment is to be proposed at the next International Postal Congress (amendment to Article XIX (samples), 4 of the Regulation of Details and Order) whereby such subjects shall be admitted to the mails at the rate of samples of merchandise.

Therefore, be it *Resolved*, That it is the sense of the New York Entomological Society that the amendment should be adopted, and

Resolved, That the Postmaster-General be requested to instruct the American delegate to vote for the same.

The delegates of this Society were requested to also bring the resolutions before the Scientific Alliance.

The President appointed Messrs. E. G. Love, J. L. Zabriskie and H. G. Dyar to act as auditors for 1897.

Mr. Loos on behalf of the Agassiz Chapter asked permission to join our field meetings. On motion the Chapter was invited to take part in our field meetings.

The Publication Committee reported that they had arranged for two lectures; one by Prof. Lyman A. Best, on Insect Mimicry, on April 10th, and the other by Dr. E. G. Love on the Study of Insects and their Transformations on April 24th.

Mr. Zabriskie exhibited the secondary parasites on *Chlamys plicata*, the generic name of which he stated was *Teterasticus*. He also showed the parasite from the eggs of *Chelymorpha argus*.

A paper on the Protective value of Action, Volitional or otherwise in "Protective Mimicry," by Mr. F. M. Webster, was read and discussed by the members (antea, p. 67).

MEETING OF APRIL 6, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Ten members present.

The Corresponding Secretary reported that he had sent the Resolutions on postage, which were offered at the last meeting, to the Postmaster General. Dr. Dyar was instructed to notify other scientific societies of the resolutions, and to request their coöperation.

A request from the Swiss Entomological Society, to exchange publications was received and referred to the Publication Committee.

Tickets for the annual reception of the New York Microscopical Society were received and acknowledged with thanks.

The Publication Committee reported that final arrangements had been made for the two public lectures by the Society, and tickets for the same were distributed.

Dr. Dyar spoke on the geographical distribution of the Eucleidæ with relation to past geological conditions. Maps of the former distribution of land and water were shown, so far back as the early Mesozoic (Triassic). It was shown that on the assumption that the Eucleidæ had never crossed considerable areas of water, that it was necessary to regard their origin as dating from this early period. Their present geographical distribution was also explained. There are no known fossils in this family, which renders direct palæontological evidence unavailable. Mesozoic insects in general are known to be similar to those now existant as remarked by Germar, and Bar is of the opinion that the absence of flowers in the Carboniferous is no proof of the absence of Lepidoptera. A mine of a Tineid is known from the Cretaceous. Now the Eucleidæ, in respect to the moths are not so highly specialized as many Tineids, and it seems possible that they may have existed in the Triassic in spite of the absence of fossil Lepidoptera an order which seems unusually poorly represented in the rocks. However, Dr. Dyar showed conditions which may have been capable of transporting the Eucleidæ across areas of water, showing that the present argument may be more interesting than conclusive. After discussion, adjournment.

THE

NEW YORK ENTOMOLOGICAL SOCIETY.

Organized June 29, 1892.—Incorporated June 7, 1893.

The meetings of the Society are held on the first and third Tuesday of each month (except July and August) at 8 P. M., in the AMERICAN MUSEUM OF NATURAL HISTORY, 77th Street and Eighth Ave.

Annual dues for Active Members, $3.00.

Members of the Society will please remit their annual dues, payable in January, to MR. C. F. GROTH, Treasurer, 139 East 40th Street, New York City.

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JOURNAL

OF THE

New York Entomological Society.

Vol. V. SEPTEMBER, 1897. No. 3.

NEW SPECIES OF TENTHREDO.

By Alex. D. MacGillivray, Ithaca, N. Y.

The species described below are arranged analytically so that the labor of reading descriptions in determining specimens may be reduced to a minimum. The grouping is the same as that used by Norton in the Transactions of the American Entomological Society and consequently can be compared directly with it.

1. Antennæ wholly or in part pale.....2
   Antennæ wholly black.....5
2. Antennæ wholly pale.....3
   Antennæ in part black.....4
3. Abdomen black at base and rufous at apex, with the basal plates rufous.
   redimaculus *MacG.*
   Abdomen entirely black. ♀.—Black, with the following parts whitish-fuscous: the labrum, the base of the mandibles, the apical half of the front femora beneath, and a square spot on the sides of the basal plates; the antennæ pale luteous beyond the second segment; the clypeus squarely emarginate; the third segment of the antennæ one-fourth longer than the fourth; wings hyaline, very slightly infuscated; the veins, including the costa and the stigma, black. Length, 12.5 mm. Habitat.—Jay, Vermont (A. P. Morse.)
   dubitatus, sp. nov.
4. Abdomen rufous beyond the basal plates.....**basilaris** *Prov.*
   Abdomen rufous beyond the third segment.....**bilineatus** *MacG.*
5. Head more or less yellow above the base of the antennæ.....6
   Head black above the base of the antennæ.....12
6. Abdomen wholly or in part yellow.....7
   Abdomen wholly or in part rufous.....9
7. Pectus pale.....8
   Pectus black. ♀.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at apex, a triangular spot between and beneath the antennæ, the lower half of the cheeks, an ovate spot above the base of each antennæ, the inner margin of the eyes (interrupted opposite the bases

of the antennæ, extending beyond the eyes, and dilated behind), a spot on the collar, the tegulæ, a large spot above the anterior coxæ, a large spot on the pleuræ, an oblique line on the metapleuræ, a spot above the posterior coxæ, the scutellum, the legs, including the coxæ, except a black line above and the apices of the posterior tarsi, and a longitudinal band on each side of the basal plates and abdomen (appearing as a lateral margin to the tergum and the venter, its mesocaudal angles on each dorsal segment produced internally, and a narrow line on the caudal margin of the ventral segments); the clypeus emarginate; the third segment of the antennæ one-third longer than the fourth; the wings hyaline, slightly clouded; the veins, including the costa, black; the stigma brownish, paler beneath. Length, 10 mm. Habitat.—Olympia, Washington (Trevor Kincaid)....**perplexus**, sp. nov.

8. Posterior tibiæ black above. ♂.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at apex, the face beneath the antennæ, an ovate spot above the base of each antenna, the cheeks almost entirely, the inner margin of the eyes (reaching beyond the eyes and dilated behind), a broad line on the collar, the tegulæ, a large spot above the anterior coxæ, the mesopleuræ and the metapleuræ except a narrow black line between them, the scutellum, the postscutellum, the basal membrane, the sides of the basal plates, a line on the posterier margin of the basal plates, the prosternum, the pectus, all the legs except a black line above and the posterior tarsi, the venter, the first and the second segments of the tergum except a black spot at base, and the remainder of the tergum; the clypeus squarely emarginate; the third segment of the antennæ one-fourth longer than the fourth; the wings hyaline; the veins, including the costa, black; the stigma black, brownish at base and apex. Length, 10–11 mm. Habitat.—Olympia, Washington (Trevor Kincaid); Juliætta and Moscow, Idaho (Professor J. M. Aldrich)..... .....**iinipes**, sp. nov.

Posterior tibiæ black at apex. ♀.—Black, with the following parts yellowish-white: the labrum, the clypeus, the mandibles except at apex, the cheeks, a spot above the base of each antenna, the tegulæ, a large spot on the collar, a spot above the anterior coxæ, a broad stripe on the pleuræ, a spot above the posterior coxæ, the front and middle coxæ except above, the apices of the posterior coxæ, the trochanters, the front legs beyond the coxæ (the tibiæ and the tarsi are greenish), the middle femora (one specimen has a small black spot on the apex above), the middle tibiæ except a black spot at apex above, the basal segment of the middle tarsi beneath, the basal half of the posterior femora, the posterior tibiæ except at apex, the scutellum, a line on the postscutellum, the basal plates, the venter except the apical segment and the sheaths of the ovipositor, and the sides of the segments of the tergum (their inner caudal angles dilated along the caudal margin of the segments, coalescing at middle) except on the fifth segment (the black on the middle of the tergal segments is in the shape of a wide equilateral triangle, in one specimen the fourth segment is entirely pale); the clypeus emarginate; the third segment of the antennæ twice the length of the fourth; the wings hyaline, slightly infuscated towards the apex; the veins and the costa black; the stigma fuscous, paler beneath. Length, 11 mm.

♂.—The markings have more of a greenish tinge, with the following differences in the arrangement of the pale markings: a spot on the middle of the pectus, the five basal ventral abdominal segments (the remainder black), and the apical two-thirds of the third and the fourth segments of the tergum yellowish (the following segments black). Length, 11 mm. Habitat.—Olympia, Washington (Trevor Kincaid); Seattle, Washington (S. Bethel). **obliquatus**, sp. nov.

9. Pectus pale.....10
Pectus black.....11

10. Anterior tibiæ with a black line above. ♂ ♀.—Black, with the following parts yellowish-white: the clyepus, the labrum, the mandibles except at apex, the face below the antennæ, a line on the inner orbits extending half way to the caudal margin of the head, the cheeks broadly, the collar, the tegulæ, the pronotum at side, the V-spot, two spots on the postscutellem, the caudal portion of the metathorax, the prosternum, the pectus, the pleuræ, a line at the base of the wings, a spot above the posterior coxæ, the sides of the basal plates, the venter, the coxæ and trochanters, the anterior femora except a short line at apex above, and the remainder of all the legs except a black line above and the most of the posterior tibiæ; the tergum beyond the third segment, including the saw-guides, rufous; the third segment of the antennæ twice as long as the fourth; the wings hyaline; the veins black; the stigma pale at base. Length, 10 mm. Habitat.—Franconia and Mt. Washington, N. H. (Mrs. Annie Trumbull Slosson)..... **secundus**, sp. nov.

Anterior tibiæ wholly pale. ♀.—Black, with the following parts yellowish-white: the clypeus, the labrum, the mandibles except at apex, the cheeks entirely, the inner margin of the eyes, extending beyond the eyes (the cephalic margin of the black spot on the vertex trilobed), a spot on the collar, the tegulæ, a spot above the anterior coxæ, the V-spot, a broad angulate mark on the pleuræ, a line on the metapleuræ, a spot above the posterior coxæ, a spot on the pectus, the postscutellum, the basal membrane, the sides of the basal plates, the first abdominal segment, the venter at base, and the front legs beneath; the legs rufo-luteous except the parts named above and a black spot on the apex of the anterior femora above and a black ring on the basal one-third of the posterior tibiæ; the five apical abdominal segments, including the venter, rufous; clypeus squarely emarginate, the third segment of the antennæ one-third longer than the fourth; the wings hyaline, slightly yellowish; the veins brown; the costa and the stigma luteous, the apex of the stigma brownish. Length, 12 mm. Habitat.—Winchendon, Massachusetts (A. P. Morse) .....**simulatus**, sp. nov.

11. Anterior tibiæ black above.....***magnificus** *MacG.*

Anterior tibiæ wholly pale. ♀.—Black, with the following parts yellow: the clypeus, the labrum, the front beneath the antennæ, a spot above the base of each antenna, an ovate spot at the inner angle of the eye, the cheeks, the collar, the tegulæ, a triangular-shaped mark on the pleuræ, the posterior mesal portion of the pectus, the front and middle coxæ, the posterior coxæ

* This species was originally described as a *Macrophya*.

except at base, the trochanters, the front and middle femora except a black line above, the front tibiæ except a dash above at base, the middle tibiæ except a black line above, the posterior femora at base, the posterior tibiæ beneath slightly at base, the front and middle tarsi and the apical segment of the posterior tarsi, a spot above the posterior coxa and the side and venter of the basal plates and the three basal abdominal segments; the abdomen, except the saw-guides, rufous beyond the third segment; the third segment of the antennæ one third longer than the fourth; the wings hyaline, very slightly yellowish; the costa, the stigma, and the veins luteous; the clypeus broadly and roundly emarginate. Length, 11 mm. Habitat.—Mt. Washington, N. H. (Mrs. Annie Trumbull Slosson.) ..... **novus**, sp. nov.

12. Pectus pale..... 13
Pectus black..... 21
13. Posterior femora wholly or in part pale above 14
Posterior femora black above..... 17
14. Posterior femora fulvo-ferruginous or sanguineous..... 15
Posterior femora in part black..... 16
15. Abdomen wholly ferruginous..... **frigidus** *MacG.*
Abdoman in part black. ♂.—Black, with the following parts whitish: the clypeus, cheeks, a fine line on the latero-caudal margin of the pronotum, the tegulæ, a spot on the pleuræ, a spot on the pectus, a spot above the posterior coxæ, the sides of the basal plates, a line on their posterior margin, and the anterior coxæ; the legs, including the coxæ, shading from luteous to rufous except a spot on the trochanters, the base of the femora above, a black line on the apex of the posterior tibiæ above, and the posterior tarsi; the abdomen, including the venter, rufous, except a transverse spot on the base of the first segment and the apical segments; the clypeus deeply and squarely emarginate; the third segment of the antennæ one-third longer than the fourth; the wings hyaline, yellowish along the veins; the veins brownish; the costa and stigma black. Length, 11 mm. Habitat.—Olympia, Washington (Trevor Kincaid)..... ..... **pallipectis**, sp. nov.
16. Four anterior femora wholly pale. ♀.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at tip, the cheeks, the face beneath the antennæ, a spot above the base of each antennæ, the collar, the tegulæ, the ventral margin of the pronotum, an angular mark on the pleuræ, a spot above the posterior coxæ, the pectus at middle behind, the coxæ except the base of the posterior pair, the trochanters and the base of the femora; the following parts rufous: the front and middle legs slightly beyond the middle of the femora, the middle of the posterior femora, the basal three-fourths of the posterior tibiæ, and the abdomen beyond the basal plates except the saw-guides; the posterior femora and tibiæ black at apex; the wings luteous; the veins brown; the costa and stigma luteous except the apex of the stigma. Length, 11.5 mm. Habitat.—Mt. Washington, N. H. (Mrs. Annie Trumbull Slosson)..... **pallicolus**, sp. nov.
Four anterior femora with a black line above. ♂.—Yellow, with the following parts black: the antennæ, the head except an ovate spot above the base of each antennæ, the basal two thirds of the cheeks, the clypeus, the labrum, the

base of the mandibles, a spot on the pronotum, deeply angulate beneath, the mesothorax and the metathorax except the scutellum, a spot on the pleuræ, the pectus, a spot above the posterior coxæ, the basal one-half of the basal plates, a line on the base of the first abdominal segment, and a spot on the apex of the femora; with the following parts rufous: the apical segments of the abdomen, the apex of the posterior tibiæ and the posterior tarsi; the clypeus squarely emarginate; the third segment of the antennæ twice the length of the fourth; the wings yellowish hyaline; the veins blackish; the the costa and the base of the stigma luteous; the apex of the stigma brownish. Length, 11 mm. Habitat.—Olympia, Washington (Trevor Kincaid.) **magnatus**, sp. nov.

17. Posterior tibiæ black. ♂.—Black, with the following parts yellowish white: the clypeus, the labrum, the mandibles except at apex, the cheeks, an interrupted line on the pleuræ, a line on the collar, a spot on the tegulæ, a spot above the posterior coxæ, the sides of the basal plates, a spot on the pectus, the coxæ, the trochanters, the femora except a black line above, the front and middle tibiæ beneath, the venter, and a narrow margin on the apex of the second and third abdominal segments; the clypeus narrowly and squarely emarginate; the third segment of the antennæ one-third longer than the fourth; the wings hyaline, the apical third smoky; the veins, including the costa and the stigma, black. Length, 13 mm. Habitat.—Olympia, Washington (Trevor Kincaid)..... **nigritibiales**, sp. nov.

Posterior tibiæ in part pale above..... 18

18. Four anterior tibiæ entirely pale.....19

Four anterior tibiæ with a black line above. ♂.—Black, with the following parts yellowish-white: the clypeus, the labrum, the mandibles except at apex, the cheeks for two-thirds the length of the eye, the palpi, the tegulæ, a broad mark on the collar, an oblique spot on the pleuræ, a spot on the pectus, a spot above the posterior coxæ, the sides of the basal plates, the coxæ and the trochanters except a black line above, the front and middle femora, the tibiæ and the tarsi except a black line above, and the posterior femora (becoming rufous towards the apex) except a black line above; the following parts rufous: the posterior femora and tibiæ and the abdomen beyond the basal plates; the clypeus squarely emarginate; the third segment of the antennæ twice the length of the fourth; the wings hyaline; the veins black; the costa and the stigma luteous, darker at their juncture. Length, 10.5 mm. Habitat—Olympia, Washington (Trevor Kincaid). This species has been sent to some correspondents under the name *rubelloides* ..... **messica**, sp. nov.

19. Collar pale.....20

Collar black. ♂.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at tip, the cheeks, the tegulæ, a spot on the posterior part of the mesopleuræ, a spot above the posterior coxæ, a vertical line beneath the posterior wings, the sides of the basal plates, the basal membrane, and the coxæ, trochanters, and front tibiæ except a black line above; the following parts rufous: the abdomen, including the venter beyond the basal plates, the middle and posterior femora except a black line above, the

tibiæ and the tarsi; the head and thorax densely and finely punctulate; the wings luteous; the veins, including the costa and stigma, black; the third segment of the antennæ twice as long as the fourth; the clypeus squarely emarginate. Length, 12 mm. Habitat.—Seattle, Washington (S. Bethel). **stigmatus**, sp. nov.

20. Pleuræ and pectus marked with rufous.....**ventricus** *MacG.*

Pleuræ and pectus marked with yellow. ♂.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at apex, the cheeks, the tegulæ, a spot on the collar, a spot above the anterior coxæ, the prosternum, the pectus, an angulate mark on each pleura, the coxæ and trochanters beneath, the front and middle femora beneath, the front tibiæ beneath, the suture between the mesothorax and the metathorax, a spot above the posterior coxæ, a spot on each side of the basal plates, and a fine line on the caudal margin of the basal plates; the following parts rufous: the posterior femora, the middle and posterior tibiæ, the front and middle tarsi (the posterior tarsi are black), and the abdomen beyond the middle of the first segment; the clypeus roundly emarginate; the third segment of the antennæ one-fourth longer than the fourth; the wings hyaline; the veins brown; the costa and the stigma luteous. Length, 12 mm. Habitat.—Plattsburg, New York (H. G. Dyar).....**hyalinus**, sp. nov.

21. Four anterior femora and tibiæ black above. ♀.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at apex, the cheeks, two spots above the base of the antennæ, the tegulæ, the collar, a line on the pleuræ, the ventral part of the pronotum, a vertical line beneath the posterior wings, a spot above the posterior coxæ, a spot along the lateral margin of the coxæ at apex, the legs beyond the coxæ except above, a longitudinal band along each side of the abdomen, and the caudal margin of the ventral segments; the wings slightly infuscated; the veins and the stigma black, the stigma some paler at base; the third segment of the antennæ twice the length of the fourth; the clypeus squarely emarginate. Length, 9 mm. Habitat.—Colorado (Carl F. Baker).....**lateralbus**, sp. nov.

Four anterior femora and tibiæ rufous. ♀.—Black, with the following parts yellowish: the clypeus, the labrum, the mandibles except at apex, the collar, the tegulæ, a line on the pleuræ, a spot above the posterior coxæ, the sides of the basal plates, the coxæ and trochanters except a black line above, and the front femora, tibiæ, and tarsi beneath; the following parts rufous: the front femora above except a black spot at apex, the front tibiæ and tarsi above, the the middle and the posterior legs beyond the trochanters except a black spot at the base of the femora above, a spot on the apex of the second and third abdominal segments, and the following segments, including the venter; the clypeus deeply emarginate; the third segment of the antennæ one-third longer than the fourth; the wings hyaline, the veins black; the costa luteous; the stigma brownish. Length, 10 mm. Habitat.—Olympia, Washington, (Trevor Kincaid)..... **capitatus**, sp. nov.

NOTES ON THE TRANSFORMATIONS OF HIGHER HYMENOPTERA.—III.

BY A. S. PACKARD.

Megachile (possibly **centuncularis** *Linn.*).

Larva.—Head of the usual proportions, of good size compared with the rest of the body. Eye-pieces prominent, full and convex. Towards but below the vertex, in between the eye-pieces, is a depressed subcordate area, with a subacute depressed tubercle on each side of the median line, which may be the antennæ; between this area and the clypeus is a transverse raised portion; on each side of this ridge and aligned with the side of the labrum at its base is a minute corneous tubercle, which may be the antennæ, though I think not.

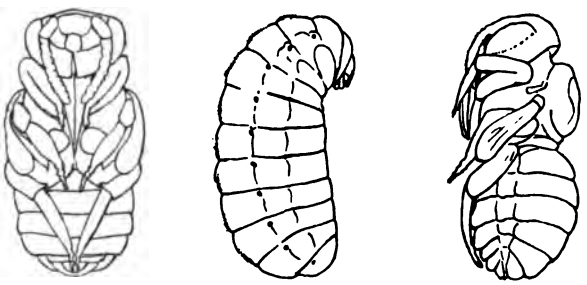
The clypeus is considerably shorter than broad; its base is a little subacutely produced onesidedly, the front edge deeply excavated; the surface is not convex and increases in width towards the anterior edge. The labrum is broadly subtrapezoidal, twice as broad as long; base rounded, semi-circular; anterior edge rather deeply excavated, rendering it slightly bilobate. Mandibles slender, not narrowing much towards the end, which is unequally bidentate, the inner tooth the smaller; they are much broader, stouter and thicker at the end than in *Andrena*.

The maxillæ are long and slender, acutely pointed at the tip on one side, the inner lobe being produced and incurved, while the outer acute lobe or tubercle is minute; this is easily overlooked and more remote from the other lobe than usual; they are long enough to touch each other. The labium is long, square at the end, corneous; below and posterior to this square corneous or chitinous edge are two minute acute spines on each side of the labium, which are probably the rudimentary labial palpi.

The body is thickest towards the posterior end, on the terminal fifth of the body, whereas in *Andrena* it is thickest at about the middle; towards this last fifth the body gradually increases in thickness, and then suddenly rounds off, so that the end is much rounder, more obtuse than in *Andrena* and the larva of Apidæ in general. The penultimate sternite is larger and broader than in *Andrena*, while the last sternite is smaller; differences readily appreciable. On the whole the larva of *Megachile* resembles that of *Bombus* more than that of *Andrena*.

As regards the head characters, the larval *Megachile* differs from the

larva of *Andrena* in its head being a little larger, the antennal tubercles being flatter and much less prominent; the eye-pieces less globose and spreading less laterally. The clypeus is longer and larger, and the front edge deeply excavated, where in *Andrena* it is square and entire. The labrum is narrower, the front edge more excavated, being hardly at all so in *Andrena*. The mandibles are stouter; the maxilla large and slender, as is the labrum, which has a broad, thickened, square chitinous tip, not present in *Andrena*, the end of which in *Andrena* is fleshy.



b *a* *c*

Fig. 9. *Megachile centuncularis*. *a*, larva; *b*, *c*, pupa. (Emerton, *del.*)

Pupa.—Head broad and flat, subtriangular, the front flattened; the supraantennal area broad and flat; seen laterally the head is much more vertical than in *Bombus*, and is more like *Apis*; seen from above the head is much broader, supraclypeal piece transversely oblong-triangular, thus setting the antennæ far apart. Clypeus transverse, broader than long, with two curvilinear lateral lobes which are much longer and more curved than in *Bombus*. Labrum square, longer than broad, the edges square, the sides contracting slightly towards the anterior edge, which is square, not rounded or excavated. Mandibles long, stout, thick, not incurved, but rather bent inwards so as to meet just in front of the labrum. The eyes are more prominent and farther apart than in *Bombus*. Antennæ more rectangularly bent than in *Bombus* owing to the greater width of the head; the joints are shorter, much more convex; only reaching to just beyond the middle of the anterior tarsi, whereas in *Bombus* they reach to the second joint of the posterior tarsi. The maxillæ reach just beyond the anterior tarsi; neither pair of palpi are visible. Paraglossæ extending to half-way between tips of lingua and the maxillæ. The mouth parts are less loosely arranged on the breast than in *Rhopalum*, *Pelopæus* and the other fossorial forms.

The legs are very short compared with those of *Bombus*, only the last pair meeting, the terminal joints of the tarsi folded together and lying contiguous to each other; tarsi much shorter and thicker than in *Bombus*.

Abdomen broader and squarer, more truncated at tip than in *Bombus*, the terminal urites as in *Bombus*; the rhabdites nearly retracted, forming a pair of papillæ which are rounded and thick.

The body is less curved on itself and the prothorax shorter. The mesoscutellum is less prominent and convex, while the abdomen is longer and narrower; the segments more thickened at the end, and spined more prominently.

The tegulæ are, as in *Bombus*, divided into an anterior flattened area, on the side of which, just above the pleurites, are the spiracles, and a posterior raised thickened area on the posterior half of the segment, which is much flatter, less ridged and convex than in *Andrena*, resembling *Bombus* more in this respect; this flattened ridge widens more towards the pleurites. The pleural region with elevated thickened tubercles, a separate knob on each segment. The ridges on the tergites and pleurites are no more distinctly marked on the prothorax than elsewhere, and not, in fact, so much as on the abdomen. Beneath the sternites are a little more ridged, more convex than in *Andrena*. The whole surface above and beneath is covered with minute hairs, which are absent in *Andrena*.

The pupa can at once be distinguished from that of *Andrena* by the prothoracic segment not being thickened any more and not quite so much as the abdominal ones, by the head being a little larger, and by the body not so rapidly tapering towards the head, and being thickest on the posterior one-fifth.

In all these characters *Megachile* closely approaches *Bombus*. In the head-characters it closely resembles *Bombus*; the clypeus, however, is not so small and distinct, and the labrum is a little larger, and less distinctly bilobate, while also the supraclypeal area is quite different, not being so triangularly depressed; posteriorly the shape is much the same. The labrum differs in the tips being rounded, fleshy, and with a terminal lunate area. The maxillæ are more acute, terminating in longer spines. The body is broader and flatter, the pleural region a little more prominent, and the terminal segment quite different, the tergite being much smaller than the sternite, which is very different from that of *Bombus*. *Megachile* does not have the minute thoracic tubercles ending in minute spines present in *Bombus*; the thickenings of the rings posteriorly are more marked in *Megachile* than in *Bombus*, and the body is more hirsute.

Ceratina dupla *Say.*

Larva.—The following description was drawn up from living specimens.

Head rather long and narrow, as in *Megachile*; full and convex; the vertex elevated convex, with fine hairs; front scarcely so broad as in *Megachile*. Clypeus full, convex. Labrum exserted, square, thick and very prominent; end much thickened, excavated beneath. Mandibles as in *Megachile*, long and thick, suddenly bent in under the labrum, so that the tips are not visible. Antennæ rather thick, bent at a considerable angle on the side of the clypeus; the scape longer and slenderer than in *Megachile*, the flagellum a little clavate, the tips reaching to the end of the maxillary palpi, or near the tips of the first tarsal joint when the leg is normally folded. Ocelli similar to those of *Megachile*, forming raised, acute papillæ; the maxillæ are nearly twice as long as in *Megachile*, reaching to the middle of the body and to the second pair of trochanters. The palpi three-jointed, rapidly tapering toward the tip; the basal joint much the largest. Labial palpi two-jointed, reaching to the tip of the second pair of legs; lingua long and slender, like that of *Bombus* in length, reaching to the

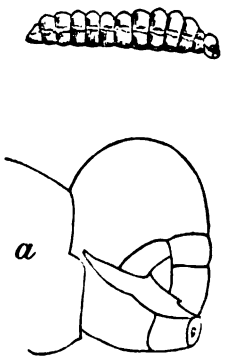


Fig. 10. *Ceratina dupla.* Larva; *a*, head enlarged. (Trouvelot, *del.*)

tip of the second abdominal segment. The legs much slenderer than in *Megachile*, the tarsal joints especially slenderer and longer than in *Megachile*, and reaching the same relative distances toward the tip of the body. In the median line of each of the second to the fifth abdominal segments is an acute spine, the hind tarsal joints lying on each side of and parallel with them; these spines I have not before noticed. The last sternite is full and large, rounded triangular. The ovipositor

is exserted, the rhabdites, as usual, forming a square tip. The thorax above is much as in *Megachile*, but the abdomen is more contracted at base, and a little more acutely produced at tip, but otherwise much as in *Megachile*; the edges of the abdominal segments are posteriorly much thickened and minutely dentate. Length, .30 inch.

It differs from *Megachile* in its longer, narrower head, narrower full clypeus, the shorter, squarer labrum, the long lingua and maxillæ, the latter being nearly twice as long as in *Megachile*, also in the presence of the four acute spines along the under side of the abdomen, as well as in the longer, slenderer legs and the narrower base of the abdomen.

Xylocopa virginica (*Drury*).

Larva.—Received July 8 from M. James Angus, of West Farms, N. Y.

Length, 1 inch; thickness, .28 inch. Larva nearly full grown. The head is very small, and the jaws move rapidly, being thrust out back and forth from beneath the labrum, which is very movable. Body cylindrical and tapering to a point, so as to be very much alike at both ends. The usual lateral swollen area is very faintly marked, rendering the body still more cylindrical than usual. The segments of the body are quite convex, the sutures being rather deeply impressed, but they are not tuberculated above, though somewhat thickened on the hinder edge.

The larva is much like that of *Bombus*, but slenderer and tapering more towards each end.

Fig. 11. *Xylocopa virginica*. Larva natural size. (Emerton, *del.*)

Anthrax sinuosa *Wiedermann.*

Larva.—We received July 8, 1867, from Mr. James Angus, the larva of this species (see Guide to Study of Insects, 397), but have not published the following description: Body smooth, flattened, slowly tapering towards each end, so that it is difficult to tell which is the head or tail end. The head is oblong, with the jaws on the under side, re-

tracted. The segments above not very convex, though the sutures are very distinct and well impressed. Laterally they dilate into a large subacute tubercle. The end of the body is smooth, rounded, subacute. There are no hairs. Color dusky, white on the head and end of the body. Length of body, .20; width, .05 inch.

Bombus fervidus.

Nesting-habits, Larva and Pupa.—The nest and young of this species, together with the bees, were found by Mr. F. W. Putnam, at Bridport, Vt., August 5, 1863. The nest occurred with several others under the grass in deserted mice nests. There were only three imago bees in the nest, as it was collected at noon time when the rest of the colony was out. One bee, however, left its cell soon after the brood was collected.*

All the workers, sixty-five in number, had escaped from their cells and deserted the nest, the brood-cells having had their upper third irregularly eaten away. The bodies of four or five workers remained in certain cells in which they had died. I have never found any traces of ichneumon parasites in any *Bombus* nest.

Dimorphic Forms.—The colony also contained 13 males, 5 small and 8 large individuals; also 9 queens, of which 3 were small and 6 large. The measurements were as follows:

Average length of 4 workers with the hair all grown, .55 in.; breadth, .35 in.

Average length of 3 females, with the hairs just beginning to grow, .62; breadth, .38 in.

Average length of 6 females, naked and white, .67; breadth, .43 in.

Average length of 5 males, dark and hairy, .52; breadth, .30 in.

Average length of 8 males, naked and white, .55; breadth, .33 in.

From this it will be seen that there are two sizes of males and two of females, among bumble bees. Whether this holds good for the workers must be proved by further observations.

In the two sets of males and females there was as much variation in length between the individuals as between the two sizes taken collectively. The difference in size between the smallest males and females was .10 inch, and the difference in size between those of the larger set was from .01 to .12 inch; the difference in size between the smallest male and the largest female was .25, being .3 more than one-half the length of the smallest male.

* Also see notes on the habits of some species of bumble bees, by F. W. Putnam. Proc. Essex Institute, IV, October, 1864, 98–104.

Of the first brood of males and females the latter were not nearly so dark and hairy as the males, which were just ready to leave their cells, except one which was a subimago.

I first observed this dimorphism in the pupæ taken from this nest; it was better seen than in examining the adult bees.

The eggs are elongated cylindrical, with the ends truncated and rounded off; and they are slightly curved in themselves.

Larva of Worker.—In their general form the larvæ of *Bombus* agree closely with those of *Apis* and *Megachile*. In outline lunoid the body is thick, cylindrical, though a little flattened, and the rings rapidly diminish in width towards each end of the body. In their natural attitude the larvæ when in their cells are doubled upon themselves, so that the under side of the head is closely oppressed to the tip of the abdomen. The enlarged pleural surface, which forms a raised lateral ridge, aids in giving the flattened appearance to the body. On the hinder half of each ring of the body is a tergal raised, flattened band proceeding on each side from the lateral ridge, leaving a transverse depressed ovate lanceolate area, at each end of which is a spiracle. There are ten spiracles, one for each thoracic ring and one on each of the first seven abdominal rings.

Beneath the body is flattened, and the sternal region is very distinct from the raised pleuræ. Each ring has its surface raised into two transverse ridges.

Above, the thoracic rings differ from the abdominal ones in having the raised portions cover nearly the whole surface, which actually takes place in the prothoracic ring. It is on this raised portion that the minute horny acute papillæ are situated; two for each second and third ring, and three on the middle of the prothoracic ring in a transverse line. The arrangement of these tubercles does not essentially vary in the different species. The prothoracic ring is a third narrower than in the metathoracic ring, though as long. The tenth and abdominal ring is in outline equal in size to that of the head, being orbicular when seen from behind. Its surface is marked below by an oblong square raised mesial portion, twice as long as broad. There is no anal outlet since the intestine is a blind sac. The ♀ and ♀ genitals can be distinctly seen, so that the sexes of the larvæ can be easily distinguished.

Of the two pairs of stylets on the ninth ring, the most basal and outer are triangular, and the inner sides nearly meet over the mesial line of the body. The smaller outer and more remote pair have their greatest length across the ring; their tips nearly meet on the mesial line of the

body and near the tips of the middle pair of stylets. The pair of the eighth ring is later developed. They appear first as two oval rings remote from the middle, and larger axes at right angles to body. Early in the semipupa stage, when they first appear as two slender elongated stylets, lying across the eighth ring, with square bases facing each other on each side of the mesial line of the body, while the ends look outward towards either side of the body, at this time the mesial pair or true ovipositer on the ninth ring is long and slender, while the outer pair have only their triangular tips developed, which slightly converge toward tips of second pair.

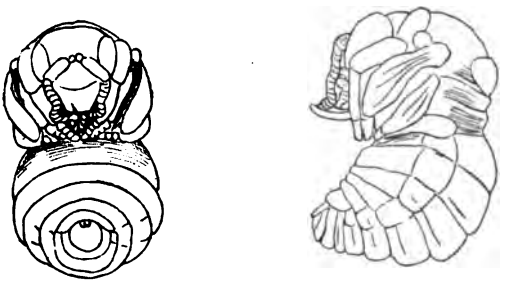


Fig. 12. *Bombus fervidus.* Pupa.

Bombus vagans.

Nesting-habits, Larva and Pupa.—In the empty cells there were no larvæ or eggs to be found. In the bottom the sides a little way up were covered with a thin layer of meal or pollen which had been placed in them by the queen, and this thin layer of refuse left had been pressed to the side of the cell by the body of the fully-fed larva which had rejected it. In one empty cell there was a considerable quantity of pollen, which was exceedingly fine, and under high powers presented a spherical shape, the surface being thickly punctured.

In the twelve workers there was no remarkable variation in size, such as was observed in another colony of pinned bees, undoubtedly of the same species. The single male was of the same size as the worker; it slightly exceeded some workers in size, but was smaller than some others; among a set of alcoholic specimens it could not at first glance be distinguished from the workers; there is no difference in the length of the maxillæ or of the labial appendages.

From the nest which Mr. Putnam found in an old stump under a barn, August 15, he took only fifteen adult bees, viz., one male, two females and twelve workers; but the number of bees then constituting the

colony could be estimated by counting the empty cells. These were wanting in the upper third, or rarely the upper half, which had been eaten away by the bees to allow the occupants to escape; the edges being rough and irregular. Some of the cells were nearly all gone, three-fourths of some of them having been removed; these were situated on the sides of or nearly beneath the bunches of small cells which surrounded the single female or queen cell.

At this date there were 58 empty cells, hence the colony, if all were alive, was of course composed of that number of individuals; of these all were workers except a single male and two females.

Larva.—The larvæ are easily distinguished from those of *B. fervidus* and *B. separatus*, which is the more unexpected, since the two last named species agree so closely after the specimens compared have been in alcohol. The head is considerably smaller, nearly one-fourth so, than in *fervidus*, while the transverse raised bands across each ring are much thicker, and the lateral raised pleural lines are much more prominent than in *B. fervidus*, thus making the under side of the body appear flatter and the upper side more convex than in *fervidus*. The whole body is more lunate, compact and blunter at the extremity than in *fervidus*. Such are the differences in comparing twenty larvæ with an equal number of those of *fervidus*. Whether these differences are constant, and have been stated correctly, future study will prove. The sizes of the different stages of growth correspond very exactly with those of the equivalent stages in *fervidus*.

Eggs.—The eggs of this and all the species when compared do not differ, and if they were all intermingled, the species could not be picked out.

Pupa.—Comparing some (eight) ♂ semipupæ with an equal number of ♀ semipupæ of *B. fervidus*, there are no differences, not even in the tip of the abdomen.

Compared with the male of *fervidus* it is very considerably smaller and slenderer, the abdomen being sensibly more produced towards the more acute tip and the limbs are throughout more slender. The head is shorter and broader. The second joint of the antennæ is longer, passing beyond the eyes, where in *fervidus* they do pass beyond the lower angle and outer edge of the eyes. The maxillæ and lingua are shorter than in *fervidus*, being just as described in the worker pupæ of *B. separatus*, and are unitedly narrow, as in the last named species. The limbs are no longer, but all the joints are considerably narrower than in *fervidus*. Here, as in the other sex, the genital armature does

not differ materially in the two species compared. Perhaps the lateral pair of stylets are shorter, while the inner mesial parallel stylets are a little longer, though these differences are only adopted provisionally. Length of ♂, .44; width, .24 inch.

Both the ♀ and ☿ are of the same size (the latter only .02–.03 less) and agree much more closely with the same states in *fervidus* than does the ♂. Still, however, the body and limbs are a little more slender, the mouth parts are shorter, and the head broader than in *fervidus*.

Average length of worker pupa .43; breadth .23 inch.

Average length of female pupa .58; breadth .28 inch.

One under-sized individual is .32 × .18.

Bombus separatus *Cresson.*

Nest, Larva and Pupa.—This nest was found by Prof. Putnam, July 23d, under the grass, in a deserted field-mouse's nest, in a rather damp situation. The active members of the colony were ten bees (no males among them), which were captured and pinned. On examining the nest I found that it consisted of 36 cells, of which all but 23 contained females and workers; of the remaining 13, which were all worker cells, two contained pollen (or honey) closely packed; the rest were empty and with the tops eaten off. The other 23 contained one worker in the semipupa stage, ten worker larvæ, one female larva, five semipupal females and four female pupæ. There were also 20 eggs and 12 young larvæ in the masses of bee head which were found attached to the sides or top of the queen cells, as shown in Fig. 13. When placed on the top of a cell the bee head formed a rounded mass, which, on be-

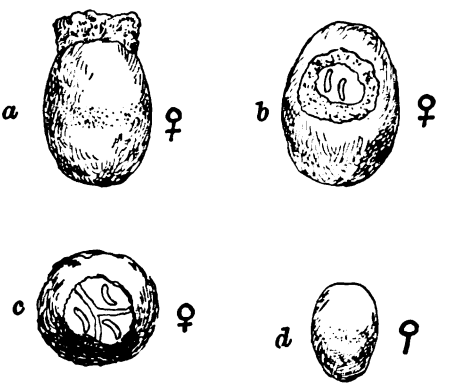


FIG. 13.—*Bombus separatus. a*, cell with mass of pollen on top; *b*, one with pollen enclosing two eggs; *c*, view from above; *d*, worker cell. (Author *del.*)

ing opened, disclosed four partitions, two at each end of the slightly ellipsoidal area, with two at each side; the two lateral ones being widely separated, but the other two only separated by a thin partition. These are walled in by the queen bee after she has placed one or two eggs in each cell. Out of this mass of food the young larvæ when hatched begin by eating the food to gradually construct their cells in the manner observed and described by Professor Putnam. One would suppose that there would be one larva only in each compartment, but on the contrary I found two young larvæ in each. The eggs are the same as those of *B. fervidus*, no specific differences being discernible.

The larvæ were young, none being more that one-third the size of the workers in the semipupa stage, while the single female larva was of full size.

The young larvæ compared with those of B. fervidus.—They are so similar that it would be impossible to distinguish them. The larvæ of *B. fervidus* differ more among themselves than do those of *B. separatus* and *B. fervidus?* The size of the head and proportions of the body, are the same. The thickened portions of the segments are also much the same, though there is a difference in that this portion is a little thicker in *B. fervidus*, but this is not a constant character. Indeed, in comparing two larvæ of the two species mentioned, each nearly a quarter of an inch long, I can see no difference between them.

Pupa of Worker.—It can best be described by comparing it with that of *B. fervidus*, of which I had the greatest number of specimens. Besides being a little smaller, it differs in form, being more plump, nearly a line shorter, and slightly broader. The head is more triangular, being shorter and at the same time proportionately broader. The eyes converge slightly towards the mouth. The antennæ and clypeus and labrum, as well as the ocelli, show no appreciable differences.

The genital armature and tip of the abdomen in general do not, contrary to our expectation, afford good specific distinctions. We see, therefore, that the pupæ differ specifically in their size and proportions, while the perfect bees have added the more readily recognized differences in coloration and hairiness.

Of the ten worker pupæ two were a little larger, almost in the subimaginal stage, and dark, and belonging apparently to the second brood of workers.

Average length of 2 worker pupæ of the first brood, .50; breadth, .32 inch.

Average length of 8 worker pupæ of the second brood, .46; breadth, .28 inch.

Female Pupa.—The pupæ of the females are equal in size to that of

the largest *B. fervidus*, and the female pupæ differ in the same characters as already given for the worker pupæ. In this species, as in all other bees and wasps, the only external difference between the workers and females is that of size.

The female pupæ are all of one and the same size, white and naked.

Apis mellifica *Linn.*

Larva of Worker.—I am not aware that a careful and comparative description of the larval honey-bee worker has been published. The following descriptive comparisons have been made with larva of the bumble bee:

Closely resembles larva of *Bombus*, but the body is shorter, broader, flatter, with the head less prominent than in *Bombus*. The body is much rounded towards the head and abdomen, tapering very equally at both ends; the segments but slightly convex, while the lateral region is less prominent than in *Bombus*, less so than usual; and the posterior portion of the segments is less thickened than usual. On the anterior part of the back (tergum) of each ring is a broad sublunate area, behind which, and especially on the sides, the ring becomes more convex. The tip of the abdomen is subelliptical, being round, but longer than broad; the tergites and sternites not well marked. It, however, resembles the larval *Bombus* quite closely. Genitals well marked on eighth ring at front edge, appearing as two minute parallel slender tubercles, also a pair on the ninth and tenth segments less distinctly marked, but a little larger. The head is of about the same proportion to the rest of the body as in *Bombus*; it is a little longer than broad, the front not very convex. Eye-ring not very full. The median line between the eyes is deeply impressed. The antennæ each form a deeply depressed minute tubercle on each side of the base of the clypeus. Supraclypeal area indistinctly marked. The clypeus is square, as long as broad, much longer and narrower than in *Bombus*. The labrum is broad, bilobate, covering the ends of the mandibles; broader and more transverse than in *Bombus*. The maxillæ are rather slenderer than usual, subacute, ending in a minute acute spine. Labrum as usual, ending in a slightly chitinous transverse ridge. Mandibles cylindrical, acute, ending in a single point, more fleshy, and more like the maxillæ than usual.

Position of Larva.—It is doubled on itself in the bottom of the cell, being more doubled than in *Bombus*, and with a softer, thinner skin. The cell of the semipupa is closed over, and the body of the latter is elongated and extended along the length of the cell. There is nothing in the shape of the larva to justify the inference that *Apis* is not a higher genus, more specialized, than *Bombus*.

ON THE WHITE EUCLEIDÆ AND THE LARVA OF CALYBIA SLOSSONIÆ (*PACKARD*).

PLATE V.

BY HARRISON G. DYAR, A. M., PH. D.

There are in Europe and Asia a number of moths colored white or nearly so, belonging to the family Hypogymnidæ (Lymantriidæ=Liparidæ). In the earlier days of the description of American species, several kinds were found superficially resembling them, which were therefore described as Liparidæ and are still listed so in Kirby's catalogue, though really presenting fundamental differences. However, as early as 1882, Dewitz showed that one of the larger species was a Eucleid from an examination of a cocoon, and, some ten years later, Packard was led to the same conclusion in describing one of the smaller species which Mrs. Slosson had then just discovered in Florida.

The species are all subtropical, inhabiting regions where not much entomological work is being done; but fortunately one of them extends into our country and I was able to discover the larva, the characters of which confirm the opinions of Dewitz and Packard. They are here presented at length.

I have examined Grote's types of *Phyrne immaculata* and *Euproctis pygmæa*, sent me by Dr. Skinner. There is no question but that the former is Packard's *Eupœya nivalis*. Grote's type bears the cocoon and number 229. This particular specimen was not sent me, but Dr. Skinner states that it is a female, which accounts for the non-pectinated antennæ. Two specimens with the same labels "Cuba" and "Dr. Wilson" were sent.

Genus **Calybia** *Kirby*.

1865.—*Phyrne*, Grote, Proc. Ent. Soc. Phil. V, 246 (preoc. Rept. 1843).
1892.—*Calybia*, Kirby, Cat. Lep. Het. I, 446.
1893.—*Eupœya*, Packard, Ent. News, IV, 169.

Synopsis of Species.

Under side of primaries entirely white.....**immaculata** *Grote.*
Under side of primaries partly gray, especially along costa.
Secondaries white above.
Primaries white above.
An inconspicuous yellowish dot near anal angle in male.
slossoniæ *Pack.*

A distinct zigzag yellow-brown mark above anal angle.
pygmæa *Grote.*
A subterminal smoky band on primaries.....**fumosa** *Grote.*
Secondaries gray above.....**jamaicensis** *Schaus.*

Genus **Leucophobetron**, nov.

There are two species which differ from *Calybia* in the much larger size (25 to 35 mm.) and the divergent tufts at the tip of the abdomen in the male, both described as Liparidæ. Dewitz has shown (N. Act. K. Leop. Deut. Akad. Nat. xliv, 252) that one of them is a *Eucleid* and it is probable that the other is also. The first is *L. argentiflua* * Geyer (Samml. Exot. Schmett, iii, pl. 18, 1836), from Cuba; the second is *L. argyrorrhœa* Hübn. (Zuträge Exot. Schmett., ii, Figs. 245, 246, 1823). For convenience I would separate them from *Euproctis* and *Eupœya* under the above term.

Synopsis of Species.

Wings with a large dark spot above anal angle.....**argentiflua** *Gey.*
Wings white, immaculate..... **argyrorrhœa** *Hübn.*

Calybia slossoniæ (*Packard*).

1893.—Packard, Ent. News, IV, 169.
1894.—Neumœgen & Dyar, Journ. N. Y. Ent. Soc. II, 111.
1895.—Dyar, Can. Ent. XXVII, 15.
1895.—Dyar, Can. Ent. XXVII, 245.

LARVA.

1897.—Dyar, Can. Ent. XXIX, 68.
1897.—Dyar, Journ. N. Y. Ent. Soc. V, 106.

SPECIAL STRUCTURAL CHARACTERS.

Outline elliptical, more narrowly so if the appendages are excluded; dorsal space broad, even, flat; lateral space broad, sloping, rounded; subventral space rather broad, continuous with the lateral space, not retracted. Ridges practically absent, the subdorsal indicated by the change in slope between back and sides. Tubercles greatly modified, as in Phobetron. In stage I a subdorsal row of single spines with enlarged bases, two on joints 3 and 13; lateral spines obsolete, represented by obscure papillæ; subventral setæ large and distinct. Ultimately the subdorsal warts are attached narrowly, but with very broad bases, encroaching on the dorsal and lateral spaces and produced later-

* Mr. W. F. Kirby has very kindly examined Hübner's works for this species and has sent me the above correction to the reference in his catalogue.

ally into fleshy appendages of nearly equal length, the anterior ones a little shorter. These appendages are constricted at about the centre of attachment, the basal portion forming an elevated heart-shaped piece, bearing seta i above, the terminal part forming a tapering horn with seta ii at the apex. The lateral row of warts are rudimentary, consisting of small, naked finger-shaped papillæ, hardly larger than the spiracles. The subdorsal horns may be detached, but less readily than in *Phobetron*, and they leave a slight scar, from which a very little fluid exudes. The appendages are situated on joints 3 to 13, one more than in *Phobetron*, and are directed downward so as touch the leaf and cover the sides. The warts bear long, finely feathery fringe-hairs with smooth bases, other short smooth hairs, short club-shaped feathered hairs and the primitive setæ i and ii. The skin is covered with a rather dense coating of fine, short, pale hairs from large colorless tubercles. No depressed spaces seen; the skin is hollowed laterally, but in an ill-defined manner. The warts are not shed on forming the cocoon. There are no stinging spines.

This interesting larva is colored to escape observation. The adaptation is the same as is *Sisyrosea textula*, but derived from a phylogenetically dissimilar stock. The fringing horns consist of the subdorsal instead of the lateral series and the fringe hairs are feathered secondary setæ instead of degenerated stinging spines.

AFFINITIES, HABITS, ETC.

The only close ally of this larva among our species is *Phobetron*, and, quite unexpectedly, it is a very close ally. Dr. Packard, judging from the moth, was of the opinion that it was not allied to *Phobetron*, placing it near *Heterogenea*. I placed it still further away, in the Megalopygidæ. The larva has all the essential characters of *Phobetron*, even in some detail. The adaptation being different, the superficial appearance is different, resembling *Sisyrosea* rather closely, but it really has no near affinity with the spiny Eucleids. From *Phobetron* it differs as follows: (1) the middle tubercle of joint 4 is absent; (2) the lateral tubercles are reduced to insignificant papillæ instead of existing as small warts; (3) the subdorsal horns are all of the same length, the weak segments of stage I appearing only in the coloration in certain examples, which lack the red tips on the horns that are short in *Phobetron*; (4) there is a horn on joint 3 instead of a small wart; (5) the color is green instead of brown, with a thinner hair coating. The larva is more specialized than *Phobetron* on the whole. In the equal length

of the horns it would be lower, except that this character may not be primary. The hairs are also less specialized.

The allies of our *Calybia* are in the West Indies and on the South American coast, as seen by the species reviewed above. *C. slossoniæ* is the Floridian representative of *C. pygmæa* Grote from Cuba, differing from it in the smaller size of the mark at the anal angle. My male specimens all possess a small but evident yellowish mark in this location. In the females it is absent.

During the winter season the cocoons of *C. slossoniæ* may be found more or less commonly on the leaves or bark of the mangrove trees throughout southern Florida. The chalky white cocoons are very conspicuous on the green leaves, but on the whitish bark hard to detect. The white color of the moth seems to have the same protective value. It is remarkable why so many of the cocoons are spun upon the leaves, as if the instinct to seek the place for which the cocoon is adapted were lapsing. As the larvæ live on a plant which is always situated in water, they never leave it, even to spin. The moths emerge in about seven weeks, but scattering. The eggs are laid almost at once. They hatch in 15 days. The larvæ are solitary, resting on the under sides of the leaves; when young they eat little spots and channels through the lower epidermis, but at maturity the whole leaf is eaten as usual.

Detailed Description of Certain Stages.

Egg.—Elliptical, flat, somewhat irregular in size and shape, but never circular; translucent, pale yellow both on glass and leaves; 1.6 ×1.9, 1.4×1.2, etc. Laid singly. Reticulations rather prominent, quadrangular, irregular, distinct. The form of the developing embryo may be rather plainly seen (Plate V, Figs. 1 to 14).

Stage I.—Head retracted, joint 2 mostly exposed. Dorsum flat, the sides nearly perpendicular, rounded. A subdorsal row of spines, the basal portion enlarged next the body, tapering, ribbed; distal part stiff, dark. Arrangement as in Phobetron except for the absence of the lower spine on joint 4. Lateral spines reduced almost to obliteration (Plate V, Fig. 15). Segments 7, 9 and 11 weak, as shown by the horns leaning out. Pale yellowish, an irregular, geminate, brown dorsal line and a broader dark subdorsal shade below the subdorsal horns. Bases of the tubercles white. Length .75 mm.

Last Stage.—Elliptical, rather thick centrally, but pressed down at each end, fringed by the conical fleshy appendages (Plate V, Fig. 22). Anterior pair short, curved, the rest straight, of about equal

length after the fourth pair. Short haired above, fringed on the sides with long, soft, white hairs (Plate V, Fig. 20), which form a continuous, thought not very conspicuous fringe. At the base of the appendages, the fleshy, heart-shaped pieces rise above the dorsum and, also above the base of the appendage, converting the dorsal area into a channel. They have short, rudimentary wing buds (Plate V, Fig. 21), besides seta i. Color light yellowish green, all the horns tipped with orange red, most so anteriorly. A blood red, diamond shaped patch with whitish centre in the depressed dorsum on joints 4–5, 7–9 and 11, four patches, the anterior one slightly elongate. Horns on joints 3 and 4 very faintly orange shaded. Sides hid by the horns, smooth, green. The traces of the lateral horns are seen with difficulty on removing the horns, as small whitish papillæ. Subventral setæ below the spiracles rather distinct. The horns arise about the centre of the segments from small depressions, and there is a smooth bulge of the skin below. The spiracle on joint 5 is in line with the others, but appears slightly unsymmetrical, rather higher on the fold in proportion. In the beginning of the stage the larva is all green, the dorsal marks appearing gradually. They vary somewhat in different examples. In another example the horns on joints 7, 9 and 11 were without the red tips. Lateral papillæ on joints 3, 4, 6 to 12, inc.

Cocoon.—Rounded, elliptical, white, with streaks of brown without, brown within; the usual circular lid (Plate V, Fig. 24). In spinning, the larva elevates the horns and begins to spin silk around the base of its body. The cocoon is thus gradually built up, supported against the larva itself until finally the horns are enclosed. They do not become detached. The silk first formed dries white, making the white color of the cocoon, through which the brown appears in spots.

Food-plant.—Mangrove (*Rhizophora mangle*).

PARASITES.

Tachinid flies, which are usually such frequent parasites of Eucleid larvæ, seem to be absent in this case. This is doubtless due to the peculiar habitat of Calybia, for if the Tachinæ should infest these larvæ, the maggots would all perish at the time of pupation by falling in the water.

Two hymenopterous parasites infest the larvæ freely. One (*Pelecystoma eupœyæ* Ashm.) destroys the life of the larva while it is in the last stage. The host retains a life-like shape, but becomes bright red (Plate V, Fig. 23) and hardens. The parasite issues from a hole in

the empty larva skin, which remains adhering to the leaf, still presenting the appearance of the figure.

The second parasite (*Crypturus dyari* Ashm.) is even more abundant, infesting nearly half of the cocoons found. It shows no sign till the larva has spun, when, instead of the moth, the hymenopteron appears, eating a jagged hole in the cocoon, instead of emerging by the lid. The full grown larvæ of the insect may be found by opening the *Calybia* cocoons at the right time. It is flattened ventrally, dorsal segments arched, distinctly segmented, 13 segments including the head. A prominent substigmatal ridge along joints 5 to 12, just below the small spiracles, fluted by the incisures. The body is thickest at joints 7 and 8 and tapers each way to the rounded ends. Head small, membranous, rounded, smooth, somewhat bulging in the position of the imaginal eyes; no ocelli; antennæ represented by two tiny points; labium somewhat prominent, the only distinct organ, with folds or sutures marked faintly in brown. Color uniform whitish yellow, slightly shiny, rather opaque. Dorsal vessel less opaque, appearing darker, substigmatal ridge whitish. The skin surface, except on the head, is marked with very small rounded colorless granules, regularly spaced at about twice their own diameter from each other. The diameter is about .01 mm. Length of larva 6.5 mm., greatest width 3.3 mm., greatest thickness 2.5 mm.

Mr. Ashmead's description of these parasites has appeared in the Canadian Entomologist.

EXPLANATION OF PLATE V.

Fig. 1. Egg; unfertilized × 13.
" 2. Egg, segmenting, 30 hours.
" 3. Embryo, 50 hours.
4. Embryo, 60 hours.
5. Embryo, 100 hours.
7. Embryo, 5 days.
8. Embryo, 7 days.
9. Embryo, 8 days.
10. Embryo, 9 days.
11. Embryo, 10 days.
12. Embryo, 12 days.
13. Embryo, 14 days.
14. Embryo, 15 days.
Fig. 15. Larva, stage I (semidiagrammatic).
" 16. Subdorsal spine of stage I enlarged.
" 17. The same, not fully expanded.
" 18. Skin setæ of mature larva, enlarged.
" 19. A short, stiff hair.
" 20. A long, feathered hair.
" 21. Short, feathery or branched hair.
" 22. Mature larva × 4.
" 23. Parasitized larva.
" 24. Cocoon on a twig.
" 25. Moth of *Calybia slossoniæ*.

NOTES ON THE PUPA OF ŒTA FLORIDANA.

PLATE VI.

BY T. A. CHAPMAN, M. D.

Length, 13 millimeters; width, 2½ millimeters. Tolerably uniform width to the fourth abdominal segment, thence tapering finally to extremity.

Color.—Deep sepia, nearly black. A pale nankeen coloring in a broad dorsal stripe, along all the abdominal segments, extending outwards as far as the anterior trapezoidal tubercles, and having a narrow double line of the dark sepia or black color down its centre; traces of a similar coloring in a narrow supra and another infra-spiracular line.

The same color surrounds the marginal tubercles and at pitted markings in the situation of the third and fourth ventral prolegs.

Similar color on the front of the headpiece and a narrow line on each side of the prothorax and a broad patch in the centre of the mesothorax, ventral line of fifth and sixth abdominal segments also paler.

Dehiscence is by complete removal of front headpiece, by splitting down the back of the prothoracic segment and two-thirds of the mesothoracic.

The antennæ separate from wings two-thirds of the way down and slightly from leg cases which also open a little at anterior ends; they remain attached together below and also to wings; eye pieces remain in situ.

The two portions of prothorax somewhat separated from mesothorax, but attached by delicate membrane, and show fine radiating structure of first spiracle. (Plate VI, Fig. 3.)

Structure.—There is no posterior headpiece; the separated front piece is roughly hexagonal, the two sides being hollowed to receive the ends of the antennæ; and in the pale area here there are on each side two spines or hairs (antennæ-basal hairs?), the inner one curled at the ends into a circle and a-half. In face piece the central portion above has three hair points on each side and terminates in a rounded projection (labrum); beneath from each side are two rounded lappets (mandibles); these occupy about the central third of the face (Plate VI, Fig. 1); at the summit of the first pair of legs between the eyes and antennæ is a small separate portion (max. palp.). The maxillæ, second legs and antennæ reach to the extremity of the wings close to the hind margin of the fourth abdominal segment, to which they are fixed.

The maxillæ just fall short sufficient to show the extremities of the third pair of legs.

The first pair of legs extends two-thirds of the way down, and between these and the maxillæ, extending one-third of the way down from nearly the top of the maxilla, is a piece (first femur) jointed in the centre. The second leg has a small facet against the maxillary palp, cutting off the first entirely from the antennæ.

Each prothoracic portion has two hair points some distance apart; the two on the mesothorax are close together.

The metathorax appears to have two pairs on each side. The hind wings do not disappear under the fore wings till they have reached the fourth abdominal segment; they present a well marked Poulton's line; this is also very well marked along the extremity of the forewing.

The first four abdominal segments are fixed; the spiracles of the second and third find room by slightly indenting the wings.

The fifth and sixth segments are free. On the second and following abdominal segments is an anterior trapezoidal and a supraspiracular hair; also a prespiracular hair; and on the fourth and following a subspiracular hair. A posterior trapezoidal is nowhere determined distinctly; but above and behind the spiracles is a small pale area with three small circular lacunæ. The abdominal spiracles project as pale truncate cones.

The last segment terminates in a conical spine apparently with an elaborate armament, and has several fine hooks round its base and some hair-like spines in the anal region; but it is impossible to clear this of silk sufficiently to make sure of anything.

The whole surface of the pupa is marked by transverse lines or sulci waved and with fine branches running into the intermediate areas (Plate VI, Fig. 7), reminding one, especially on the wings, and probably similar in structure to the sulci between cerebral convolutions; these vary very much over different parts of the pupa; on the centre of the wing, for instance, forming a vortex like the ridges of the tip of the finger. On portions of the abdominal segments the fainter markings are disposed more like the folds in a cushion where it is upholstered. These folds are very beautiful on the antennæ, but here and elsewhere are too complicated for a detailed description. The claws (Plate VI, Fig. 2) on the true legs of the larva are remarkably long and narrow, the same length, and one-fourth the width of the preceding joint; this appearance is emphasized by this joint being of very uniform width and squarely truncated at its distal extremity. The pupal nerva-

tion of the wings is indicated by paler lines. Along the inner margin of the upper wings for quite the basal half is a narrow strip almost free from surface markings; this is, however, delusive, being really the surface of hard chitin of the upper wings which touches the lower one.

NOTE.—Dr. Chapman writes: "It belongs to my section, *Pyraloids*, which have obtect structure in practically all respects except the possession of traces of maxillary palps. I should be inclined to place it somewhere near Yponomeutidæ." The anal hooks were accidentally destroyed in the specimen that I sent to Dr. Chapman. The cremaster is a long, thick and wide projection with four hooks at the end (Plate VI, Figs. 4, 5 and 6). There is also a row of hooks at the base running around the anal aperture, and a series of stiff spines further forward, as shown in the figures.

Œta aurea was originally described by Fitch as a Lithosian; Riley placed it with the Tineids at first, later with the Zygænidæ; Smith put it in the Heterogynidæ in the list of 1891, but in the addendum Walsingham's opinion is quoted that the moth belongs to the Tineidæ, thus reverting to the original position given by Fabricius. The larva is a true Tineid. (See the description in March number of this JOURNAL.)

H. G. DYAR.

EXPLANATION OF PLATE VI.

Fig. 1. Leg cases, etc., of pupa; M., mandible; m. p., maxillary palpus; mx., maxilla; 1t., anterior trochanter; 1f., anterior femur; 1., first leg; 2l., second leg; 3l., third leg; a., antenna.

Fig. 2. Claw of larva.

" 3. Anterior (prothoracic) spiracle.

" 4. End of pupa, ventral view.

" 5. End of pupa, dorsal view.

" 6. End of pupa, lateral view.

" 7. Sculpturing of pupa shell.

A COMPARATIVE STUDY OF SEVEN YOUNG ARCTIANS.

PLATES VII AND VIII.

BY HARRISON G. DYAR, PH. D.

The larvæ of the Arcticans, including in this term both Arctiidæ and Euchromiidæ, are much more highly specialized than those of the Noctuidæ. This specialization tends to force back into the first stage certain characters properly belonging to the later stages, and it is proposed to briefly consider some of the forms which this modification of stage I assumes.

The arrangement of the tubercles in stage I of the Arctians corresponds with that normal for the whole group Bombycides.* The setæ are of the finely spinulated type, with pointed tips, never glandular, in this respect distinguished from the Ptilodontidæ (Notodontidæ) and certain lower Tineid genera, as pointed out by Dr. Packard. The seven species taken to illustrate this paper, represent three unequal groups of the Arctian phylum. From the Arctiidæ proper I have taken *Spilosoma virginica* (Fig. 1), *S. antigone* (Fig. 2) and *Hyphantria cunea* (Fig. 3); from the Phægopterid group, *Halisidota maculata* (Fig. 4) and *H. caryæ* (Fig. 5); from the Euchomiidæ *Cosmosoma auge* (Fig. 6) and *Ctenucha virginica* (Fig. 7). I have arranged these as nearly as possible in ascending order of specialization, and it will be noticed how exactly this corresponds with the arrangement founded on the wing veins of the imago. That is, the *Spilosoma* group represents a more generalized type than the Halisidotas, the latter having reduced secondaries and shortened subcosta, whereas in the Euchromiidæ subcosta is entirely absent. The degree of difference of these groups also is the same in both larva and imago. While the larval Halisidotas are more specialized than the Spilosomas, they do not differ from them enough to determine family characters. The Euchromiidæ, however, do differ to this degree, the special character being the union of setæ ia, ib and iia on thorax to form a single wart. In *Halisidota*

* *I. e.*, the Noctuina as defined by me or Agrotides of Mr. Grote. I find that these names must be replaced by the old term Bombyces or Bombycides, because Bombyx really belongs to this superfamily, and not to the Saturniides, as I formerly supposed, following the conclusions of Professor Comstock. I have recently made a careful examination of stage I of Bombyx, at the suggestion of Mr. Grote, with the above result.

caryæ this process is foreshadowed on the metathorax, but while iia is partly united to i it forms a distinct wart on the mature larva.

This parallelism between the relative advance of larval and imaginal characters is worthy of notice in view of the numerous cases of the reverse tendency.

The details of the seven selected species are shown in the accompanying plate.

Spilosoma virginica.

The setæ are perfectly normal for stage I, all the subprimaries absent. Of the six primary setæ on the cervical shield, four remain on the shield, the others are detached and reduced, so that I detect only one seta on the small detached piece. The setæ of the prespiracular tubercle are also less than in the primitive Tineid stock. On the other thoracic segments, ia and ib are united, iib separate and reduced, all characteristic of the Bombycine type of wart formation. On the abdomen tubercle i is small, the rest large, vii with two setæ on segments 1 and 2, one on 7, 8 and 9, instead of the primitive three setæ; leg plates well marked. Tubercle viii present next the midventral line (not shown in the figure). "Joint 13" is evidently composed of two segments, on the anterior portion (9th abdominal) tubercles i to iii on one large wart, iv and v on another; on the anal plate (10th abdominal) all the five setæ on a single disk.

This is the type from which we start — an Arctian in the primitive first stage.

Spilosoma antigone.

The detached piece of the cervical shield is rudimentary. General tubercles as in *virginica*, except for a peculiar modification whereby tubercle iia on thorax has become three or four-haired (in different individuals) and iii on abdominal segments 1 to 8, four or five-haired; on the ninth abdominal iii seems to be only three haired, as I find but five hairs on the large wart composed of tubercles i to iii. No subprimary setæ; ventral setæ as in *virginica*.

This modification is to be interpreted as a partial wart formation, pushed back into stage I, yet unaccompanied by the subprimary setæ, which in phylogeny must have preceded any wart formation.

Not only in stage I is *S. antigone* unusually specialized for it genus, but in the later stages it has assumed the plumage and habits of *Arctai* (*Euprepia*), as noticed by Mr. Hulst (Ent. Amer., II, 16). This specialization is not shared by the imago, and is consequently without

effect on the generic location of the species; it is probably the result of comparatively recent adaptation.

Hyphantria cunea.

Tubercles small, normal, two small areas detached from the cervical shield probably represent the two outer primitive setæ. Setæ all single as in *S. virginica*, but on the thorax subprimary seta iii is situated on a small wart behind seta iv and on the abdomen subprimary vi is present on segments 1 to 8, small anteriorly, but of fair size further back.

In this larva there is no precocious wart formation, but the subprimary setæ appear in stage I almost perfectly formed (v is absent on thorax). According to my views, the *Arctiidæ* are descended from the *Noctuidæ*, and here is a case where the specialization of the larva has crowded back into stage I the typical structures of the *Noctuidæ*, the primitive first stage being absent, yet without the supervention of wart formation until stage II.

Halisidota maculata.

As in *S. virginica*, but for a doubling of setæ iii on abdominal segments 1 to 8 and the partial fusion of iv with iii. Subprimary tubercles absent.

Here we have a partial precocious wart formation in the doubled setæ on iii analogous to the condition in *S. antigone* but considerably less developed, not affecting the thorax at all. I regard this species as more specialized than the preceding chiefly on account of the fusion of tubercles iv and iii, a condition found also in some of the Lymantriidæ, a high type in another line of evolution.

Halisidota caryæ.

Tubercle iv unconnected with iii, but iii doubled as in *H. maculata*. On segments 1 to 8 subprimary tubercle vi is present. No subprimaries on thorax, but iia partly fused with i on mesothorax; otherwise normal as in *S. virginica*.

This larva exhibits a partial precocious wart formation and a partial appearance in stage I of the subprimary tubercles. It therefore shows an incompletely developed combination of the characters of *Hyphantria cunea* and *Spilosoma antigone* and is consequently higher than either. It is more advanced than *H. maculata* in the presence of the subprimaries.

Cosmosoma auge.

Tubercles weak; setæ single, normal, no subprimaries. This larva is placed higher than all the preceding on account of the complete

union of tubercles iia and i on the thorax. In other respects there is present only a normal primitive first stage, just as in *S. virginica*, except for the purely specific characters of less cornified smaller tubercles, etc.

Ctenucha virginica.

Tubercles well developed, setæ all single as in *C. auge*, but in addition subprimary vi is present on abdominal segments 1 to 8; no subprimaries on thorax.

This represents in the Euchromiid phylum the same stage reached by *H. cunea* in the Arctiid branch, but not quite fully as there is here no trace of the subprimaries on the thorax.

EXPLANATION OF PLATES VII AND VIII.

Fig. 1. Spilosoma virginica, stage I. Fig. 5. Halisidota caryæ, Fig. I.
" 2. Spilosoma antigone, " " " 6. Cosmosoma auge, " "
" 3. Hyphantria cunea, " " " 7. Ctenucha virginica, " "
" 4. Halisidota maculata, " "

PRELIMINARY HAND-BOOK OF THE COLEOPTERA OF NORTHEASTERN AMERICA.

BY ROLAND HAYWARD.

(Continued from Vol. V, p. 40.)

The present part of the "Hand-Book," relating to *Bembidium*, has been prepared at the request of the Editor of this JOURNAL, made some time ago, but the fulfilment of which has been unavoidably delayed. It is, in fact, an abridgment of a larger paper on the species occurring in America, north of Mexico, which the author had in preparation at the time when the request was made, and which has only recently been published (Trans. Amer. Ent. Soc., 1897, xxiv, pp. 32–143). To this the student is referred for more complete descriptions, as well as for bibliography and synonymy.

In order to economize space, the species have not been arranged in groups, as has been done in the paper above cited, but are all included in one table. It will be observed that in all but two of our species (*lævigatum* and *semistriatum*) the dorsal punctures of the elytra are confined either to the third interval or to the third stria. In those just cited, however, they are arranged in irregular rows on all the intervals,

with the setæ arising from them well marked. They are included in the category "third interval with dorsal punctures."

Bembidium *Latr.*

Antennæ slender, arising under a slight frontal margin, the two basal joints glabrous. Head with two supra-orbital setæ. Mandibles with a setigerous puncture in the scrobe. Palpi with the penultimate joint obconical, pubescent, the last joint small, subulate. Prothorax with a setigerous puncture each side and another in the hind angle. Elytra glabrous, striate, the margin interrupted posteriorly with an internal plica; sutural stria not recurved at apex. Mesosternal epimera wide. Middle coxal cavities entirely inclosed by the sterna. Anterior tibiæ deeply emarginate, the apical angle not obliquely truncate. Tarsi slender, the claws simple.

The males have the first two joints of the anterior tarsi dilated, the first slightly elongate, nearly quadrate, the second more or less triangular, with the inner angle slightly prolonged.

The species of this genus are very numerous. They are all below the average size, ranging from two to about nine millimeters. Most of them are riparial in their habits, though some are found in moss, amongst old leaves or under bark, while a few occur almost everywhere.

Synopsis of Species.

Eyes large or moderately large, convex. 2
Eyes small, flattened. 49
2. Elytra with the humeri subangulate, third interval with dorsal punctures.... 3
Elytra with two dorsal punctures on the third stria 12
Elytra with the humeri rounded, third interval with dorsal punctures. 28
3. Mentum with a short, bifid tooth; striæ of elytra more or less abbreviated behind 4
Mentum with a large, entire tooth; striæ of elytra entire. .....
4. Elytral intervals with rows of sparsely placed setigerous punctures. 5
Robust, convex; green or bronzed, shining; prothorax subquadrate, slightly wider at base than apex; base of antennæ and legs testaceous, the femora sometimes darker. Length, .22–.29 inch; 5.5–7.25 mm.....**lævigatum.**
Elytra with two dorsal punctures on the third interval.
Robust, slightly convex; æneous or nigro-æneous; prothorax subquadrate, wider at base than apex; antennæ black, more or less rufous at base; legs black or dark piceous, often slightly æneous, the tibiæ and tarsi sometimes rufo-piceous. Length, .18–.28 inch; 4 5–7 mm.....**nitidum.**
5. Elytra with two impressed quadrate foveæ on the third interval, each enclosing a dorsal puncture 6
Elytra without trace of foveæ; two dorsal punctures on the third interval.... 9

6. Elytra with the fourth stria sinuate..... 7
Elytra with the fourth stria straight..... 8
7. Slender, elongate, convex; thorax as long as wide, not wider at base than apex, hind angles subacute; elytra deeply striate, the striæ distinctly punctate; legs æneous, the femora at base and the tibiæ more or less testaceous. Length, .19–.22 inch; 4.75–5.5 mm..... **inæquale.**
Broader, less convex; thorax distinctly wider than long, slightly wider at base than apex; hind angles varying from subrectangular to subacute; elytra less deeply striate, the striæ more finely punctate; legs variable, usually nearly as in *inæquale*. Length, .19–.26 inch; 4.75–6.25 mm..... **littorale.**
8. Broad, slightly depressed; thorax nearly twice as wide as long, not wider at base than apex, sides arcuate in front, deeply sinuate behind, basal foveæ distinctly bistriate, hind angles subacute, carinate; elytra finely striate, the striæ finely punctate; legs varying from æneo-piceous to æneo-testaceous. Length, .22–.28 inch; 5.5–7 mm..... **carinula.**
Robust; thorax about one-half wider than long, wider at base than apex, sides slightly arcuate in front, sinuate behind, basal foveæ feebly or obsoletely bistriate, hind angles prominent, acute; elytra deeply striate, the striæ deeply punctate; legs dark æneous, the femora at base and the tibiæ more or less rufous. Length, .22–.30 inch; 5.5–7.5 mm..... **punctatostriatum.**
9. Thorax wider at base than apex..... 10
Thorax not wider at base than apex..... 11
10. Robust, bronzed, shining; thorax nearly twice as wide as long, sides arcuate in front, sinuate behind, hind angles acute, carinate; elytra moderately deeply striato-punctate; legs rufo-piceous, slightly æneous, the femora rufous at base. Length, .23–.25 inch; 5.75–6.25 mm..... **robusticolle.**
11. Feebly convex; bronzed, varying to bluish-black, shining; thorax about one-half wider than long, sides moderately arcuate in front, sinuate behind; hind angles slightly prominent, subacute, very finely or obsoletely carinate; elytra deeply striato-punctate; legs æneo-piceous, the femora at base and the tibiæ rufous. Length, .22–.26 inch; 5.5–6.5 mm..... **coxendix.**
More robust; bronzed, usually coppery, elytra with the discs obscurely testaceous; thorax rather less than one-half wider than long, sides arcuate nearly to base, feebly sinuate in front of the hind angles, which are subrectangular and feebly carinate; elytra moderately deeply striato-punctate, the punctures usually greenish; legs testaceous. Length, .18–.27 inch; 4.5–6.75 mm. **confusum.**
12. Eighth stria of the elytra moderately near, but distinct from the margin..... 13
Eighth stria of the elytra indistinct from the margin; humeri rounded..... 16
13. Humeri of elytra subangulate, all the striæ entire; hind angles of thorax not carinate; color more or less bronzed, sometimes greenish or bluish..... 14
Humeri of elytra rounded; hind angles of thorax carinate..... 15
14. Elytra with the dorsal punctures large, round, foveiform.
Thorax narrower at base than apex, sides moderately arcuate in front, slightly sinuate behind, hind angles subrectangular; elytra finely striate, very finely alutaceous, shining. Length, .20–.24 inch; 5–6 mm..... **americanum**
Elytra with the dorsal punctures normal.

Broad, dilated, depressed; thorax narrower at base than apex, sides strongly arcuate in front, sinuate behind, hind angles obtuse; elytra moderately deeply striate, much more finely at tip; legs dark rufous. Length, .26–.29 inch; 6.5–7.25 mm,.....**dilatatum.**

More elongate, feebly convex; thorax scarcely narrower at base than apex, sides slightly arcuate in front, feebly sinuate behind, hind angles subrectangular; elytra more deeply striate; legs piceous, the femora at base and the tibiæ often rufous. Length, .23–.27 inch; 5.75–6.75 mm..**honestum.**

More convex; thorax more narrowed behind, apex truncate, sides strongly arcuate in front, sinuate behind, hind angles subrectangular; elytra more deeply striate, the striæ more deeply, almost crenulately punctate. Length, .22–.25 inch; 5.5–6.25 mm.....**chalceum.**

Elongate, depressed; thorax slightly narrower at base than apex, sides arcuate infront, sinuate behind, hind angles acute, slightly prominent; elytra moderately finely striate, the striæ distinctly punctate, with an ill-defined discal spot about one-third from apex testaceous; legs rufous. Length, .20–.23 inch; 5–6.75 mm. .....**blanchardi.**

15. Robust, very convex; nigro-æneous often tinged with green; thorax one-half wider than long, narrower at base than apex; elytra deeply striato-punctate, the striæ dilated, the first and second entire, the fifth represented by a groove at apex; base of antennæ and legs rufous. Length, .15–.18 inch; 3.75–4.5 mm. .....**nigrum.**

Less convex, elongate; black, slightly æneous; thorax narrower at base than apex, apex truncate; elytra with the first, second, third and seventh striæ entire; legs dark piceous or black. Length, .15–.18 inch; 3.75–4.5 mm...**longulum.**

More robust than *longulum*; nigro-æneous, the elytra sometimes tinged with brown; thorax scarcely narrower at base than apex, about one-half wider than long; elytra with all the striæ entire; legs piceous or rufo-piceous. Length, .15–.20 inch; 3.75–5 mm.....**concolor.**

16. Thorax trapezoidal, scarcely convex, the basal foveæ distinctly bistriate with the outer stria as long or longer than the inner, hind angles distinctly carinate; legs dark.....17

Thorax trapezoidal, scarcely convex, the basal foveæ unistriate or feebly bistriate with the outer stria very small, hind angles at most very finely carinate; legs rufous or testaceous, the femora rarely darker 18

Thorax cordate, convex, narrower at base than apex; basal foveæ bistriate ..21

17. Form depressed; thorax slightly wider than long, as wide at base as apex; elytra finely striate, the striæ very finely or obsoletely punctulate; color piceous or nearly black, scarcely æneous; legs piceous. Length, .27–.35 inch; 6.75–8.75 mm. .....**planatum.**

Smaller species; striæ of elytra impunctate.

Elytra distinctly wider than the thorax; depressed, slender, elongate; nearly black, the elytra usually more or less brownish; thorax scarcely one-half wider than long, slightly narrower at base than apex, sides arcuate in front, oblique or obsoletely sinuate behind, hind angles obtuse, but not rounded; elytra moderately deeply striate; legs rufo-piceous. Length, .16–.19 inch; 4–4.75 mm.....**simplex.**

Very close to *simplex*, but less elongate; thorax scarcely narrower at base than apex, sides sinuate behind, hind angles rectangular; legs piceous or nearly black, rarely rufo-piceous. Length, .16–.20 inch; 4–5 mm... **planiusculum.**

Elytra very slightly wider than the thorax, finely striate, the outer striæ very fine, especially towards the tip, dorsal punctures large; black, more or less bronzed, depressed; thorax nearly twice as wide as long, scarcely narrower at base than apex, sides arcuate to base, hind angles obtuse, but not rounded; legs black. Length, .17–.23 inch; 4.25–5.75 mm..... **incertum.**

18. Basal impressions of thorax with the outer stria small, but distinct 19

Basal impressions of thorax with the outer stria obsolete; larger species.....20

19. Thorax distinctly narrower at base than apex.

Elongate, slender, very depressed; piceous or nearly black, the elytra more or less brownish; thorax with the sides distinctly sinuate behind, hind angles rectangular; head large, scarcely narrower than the thorax; elytra slightly wider than the thorax, subparallel, deeply striato-punctate, all the striæ entire; legs rufous. Length, .21–.25 inch; 4.25–5.25 mm..... **grandiceps.**

Thorax very slightly narrower at base than apex.

Moderately elongate, depressed; head and thorax nigro-æneous, elytra dark brown or piceous, moderately deeply striato-punctate on the disc, less so at sides and tip, the five inner striæ entire, the sixth and seventh abbreviated behind, the latter often wanting; thorax about one-half wider than long, sides feebly sinuate behind, hind angles subrectangular; legs rufous. Length, .19–.22 inch; 4.75–5.5 mm. ..... **guexi.**

Slightly elongate, less depressed, nearly black, usually slightly æneous or bluish; elytra less wide as compared with the thorax, striate nearly as in *guexi*, the six inner striæ entire, the seventh abbreviated behind or wanting; thorax more than one-half wider than long, sides obsoletely sinuate behind, hind angles slightly obtuse; legs rufous. Length, .22–.25 inch; 5.5–6.25 mm. ..... **fugax.**

20. Head and thorax nigro-æneous, the latter with the hind angles rectangular or subobtuse; elytra testaceous with darker transverse bands or nigro-æneous transversely banded with testaceous, more or less deeply striato-punctate, the six inner striæ entire, the seventh varying from entire to wanting; legs testaceous or nearly rufous, the femora rarely darker. Length, .24–.34 inch; 6–8.5 mm. .... **transversale.**

21. Elytra each with a well-defined basal and another subapical spot pale; legs rufo-testaceous 22

Elytra either immaculate or with a pale submarginal spot near the apex 23

Elytra very pale testaceous, narrowly rufous or rufo-piceous along the suture to behind the middle, where there is a large spot of the same color, often connected with the margin by a narrow transverse line; head and thorax nigro-æneous; elytra finely striato-punctate, the five inner striæ entire; legs testaceous, the femora sometimes darker. Length, .17–.20 inch 4.25–5 mm. **fuscicrum.**

22. Thorax distinctly narrower at base than apex, sides strongly arcuate in front, deeply sinuate behind, hind angles rectangular; elytra moderately deeply striato-punctate, intervals convex. Length, .21–.25 inch; 5.25–6.25 mm.... **ustulatum.**

Thorax slightly narrower at base than apex, sides moderately arcuate in front, sinuate behind, hind angles rectangular; elytra moderately finely striato-punctate, intervals nearly flat; form less convex and color more brownish than in *ustulatum*. Length, .18–.26 inch; 4.5–6.5 mm.....**lucidum.**

23. Thorax wider than long..... 24
Thorax as long as wide; nigro-æneous, elytra often brownish at base with a submarginal pale spot about one-fourth from apex, which is rarely wanting, moderately finely striato-punctate, the first and second striæ entire, the fifth represented by a groove at apex; legs rufo-testaceous. Length, .16–.20 inch; .4–.5 mm..... .....**scopulinum.**

24. Head as wide as the thorax at apex..... 25
Head small, narrower than the prothorax at apex; elytra with a submarginal pale spots near the apex, which is rarely wanting.
Elongate, convex; elytra finely striato-punctate, the striæ not dilated, intervals feebly convex; antennæ piceous, the first joint rufous; legs rufous, the femora usually darker. Length, .24–.30 inch; 6–7.5mm.**bimaculatum.**
More convex; thorax more narrowed behind; elytra deeply striato-punctate, the striæ dilated on the disc, much finer at sides and tip; antennæ fuscous, the basal joints paler; legs pale yellowish tsetaceous. Length, .24–.28 inch; 6–7 mm.....**postremum.**

25. Elytra with the first and second striæ entire, the fifth either entire or represented by a groove at tip, the others abbreviated behind..... 26
Elytra with all the striæ entire; dark viridi-æneous, the elytra without submarginal pale spot, moderately deeply striato-punctate, more finely at sides and tip; legs rufous. Length, .22–.24 inch; 5.5–6 mm.....**canadense.**

26. Hind angles of thorax rectangular 27
Hind angles of thorax obtuse, but not rounded; rather slender, elongate, color varying from brownish to black, slightly æneous; elytra without submarginal pale spot, rather deeply striato-punctate; thorax with the sides feebly sinuate in front of the hind angles; legs rufous. Length, .23–.28 inch; 5.75–7 mm. **texanum.**

27. Moderately robust; black, usually slightly æneous or bluish, the elytra rarely with a submarginal pale spot, rather deeply striato-punctate; sides of thorax distinctly sinuate behind; legs rufous. Length .20–.24 inch; 5–6 mm. **picipes.**
Elongate, slightly convex; black, slightly æneous, elytra without submarginal pale spot, finely striate, striæ distinctly punctate; legs black or dark piceous. Length, .16–.18 inch; 4–4.5 mm.....**grapii.**

28. Elytra with two dorsal punctures on the third interval..... 29
Elytra with rows of sparsely placed, setigerous punctures on all the intervals; all the striæ abbreviated behind; frontal striæ normal..... 48

29. Frontal striæ normal; elytra distinctly striate, with at least the first and second striæ entire; striæ punctate..... 30
Frontal striæ double, oblique, the outer interrupted..... 42
Frontal striæ double, nearly parallel, the outer entire..... .. 45
Frontal striæ very oblique, strongly convergent, double, the outer often very feeble, abbreviated behind 46

30. Thorax narrower at base than apex..... 31
Thorax not perceptibly narrower at base than apex..... 38
31. Form depressed; all the striæ of the elytra entire..... 32
Form more or less convex..... 33
32. Head and thorax coarsely alutaceous, cupreo-æneous, elytra testaceous with a humeral spot, a small oblong spot on third interval, about one-third from base, and two transverse bands bronzed or nearly black, the first slightly behind the middle, the second about one-fourth from apex, the last three connected by a narrow sutural line; thorax cordate, nearly twice as wide as long; base of antennæ and legs testaceous. Length, .20–.24 inch; 5–6 mm..... **cordatum.**
Dark viridiæncous, elytra with the apex, a subapical spot, and rarely a short transverse band in front of the middle testaceous; head and thorax alutaceous, the latter subquadrate, slightly narrower at base than apex, sides at most obsoletely sinuate behind, hind angles obtuse; legs rufous or rufo-piceous. Length, .15–.18 inch; 3.75–4.5 mm..... **intermedium.**
33. Elytra with all the striæ entire; thorax more or less cordate..... 34
Elytra with several striæ abbreviated behind..... 35
34. Head and thorax nigro æneous, the former finely alutaceous; elytra æneo-piceous with a subhumeral blotch, a transverse band behind the middle and sometimes the apex paler, the markings ill-defined; form elongate; legs testaceous. Length, .20–.23 inch; 5–5.75 mm..... **graciliforme.**
Head and thorax viridiæneous, alutaceous, elytra testaceous with a transverse band slightly behind the middle, another between this and the apex and sometimes a subbasal cloud fuscous, striæ scarcely less deep at tip; legs testaceous. Length, .16–.18 inch; 4–4.5 mm..... **viridicolle.**
Dark viridi-æneous, elytra usually with a narrow transverse band about one-third from base, another about one-third from apex and an apical spot testaceous, the three usually connected along the margin; head alutaceous; elytral striæ much finer at tip; legs testaceous. Length, .16–.18 inch; 4–4.5 mm. **fraternum.**
Much smaller, elongate; head and thorax black or slightly æneous, the former very finely alutaceous; elytra varying from testaceous with black markings to nearly black with paler markings; legs rufous. Length, .10–.13 inch; 2.5–3.25 mm..... **timidum.**
35. Thorax with the hind angles distinctly carinate..... 36
Thorax with the hind angles very finely or not carinate; head distinctly alutaceous; larger species..... 37
36. Head at most very finely alutaceous; form and color nearly as in *timidum*, but slightly more elongate and more convex, with the sides of the thorax usually more deeply sinuate behind; elytra with the first and second striæ entire, the fifth represented by a groove at tip; legs testaceous. Length, .10–.13 inch; 2.5–3.25 mm..... **versicolor.**
Head not alutaceous; robust; black, slightly æneous; sides of thorax arcuate in front, oblique behind, hind angles obtuse; elytra slightly wider than the thorax, with the first, second and fifth striæ entire; legs piceous. Length, .11–.13 inch; 2.75–3.25 mm..... **morulum.**
37. Moderately convex, elongate; æneous or nigro-æneous, elytra with the apex, a sub-

apical spot, often a short transverse band in front of the middle and a narrow line along the margin testaceous; thorax with the sides arcuate nearly to base, sinuate in front of the hind angles, which are subrectangular and finely, almost obsoletely, carinate; legs rufo-testaceous. Length, .17–.22 inch; 4.25–5.5 mm. ..... **constrictum.**

Convex, slender, very elongate; color nearly as in *constrictum*, the apex and margin of the elytra more or less testaceous; thorax with the sides arcuate to base, hind angles obtuse, not carinate; legs rufo-testaceous. Length, .18–.24 inch; 4.5–6 mm..... **contractum.**

38. Thorax squarely truncate at base; head alutaceous..... 39

Thorax slightly obliquely truncate each side at base..... 41

39. Hind angles of thorax rectangular..... 40

Hind angles of thorax obtuse; feebly convex; head and thorax viridi-æneous elytra fuscous, with a humeral lunule, a transverse fascia behind the middle and the apex testaceous; thorax with the sides arcuate to base; elytra very slightly wider than the thorax; legs rufo-testaceous. Length, .16–.18 inch; 4-4.5 mm ..... **æneicolle.**

40. Nigro-æneous; elytra moderately deeply striate, marked nearly as in *graciliforme*, the markings ill-defined; head and thorax rather finely alutaceous; legs varying from rufous to piceous. Length, .20–.24 inch; 5–6 mm. **dentellum.**

Brown bronze, elytra testaceous, marked somewhat as in *cordatum*, the markings ill-defined and broader; head and thorax very distinctly alutaceous; legs rufo-testaceous. Length, .17–.19 inch; 4.25–4.75 mm. ..... **versutum.**

Nigro æneous, elytra either testaceous variegated with black, or black variegated with testaceous, the markings well defined.

Legs testaceous. Length, .14–.19 inch; 3.5–4.75 mm..... **variegatum.**

Legs black or dark piceous. Length .13–.16 inch; 3.25–4 mm... **nigripes.**

41. Head not alutaceous; form and color nearly as in *postfasciatum*; elytra without postscutellar depression, more finely striate, the striæ not dilated at base, the markings narrower and paler; head and thorax bright viridi- or cupreo-æneous; legs testaceous. Length, .20–.23 inch; 5–5.75 mm..... **dorsale.**

Head alutaceous; broad, dilated; elytra more than one-half wider than the thorax, deeply striate, the striæ dilated at base, with a transverse depression behind the scutellum; head and thorax cupreo-æneous, elytra testaceous with a small spot on the third interval about one-third from base, a transverse band about the middle and another between this and the apex nearly black; legs testaceous. Length, .20–.24 inch; 5–6 mm..... **postfasciatum.**

42. Thorax cordate, pedunculate or subpedunculate; form moderately elongate; hind angles of thorax not carinate; elytral striæ abbreviated behind..... 43

Thorax cordate or subcordate, truncate at base..... 44

43. Moderately convex, slender; black, slightly æneous, elytra with a subhumeral pale spot; thorax less than one-half wider than long; legs piceous or nearly black, the tibiæ and tarsi usually paler. Length, .12–.14 inch; 3–3.5 mm. **mutatum.**

Moderately convex; brownish æneous, elytra with a subhumeral spot and usually a small submarginal one behind the middle yellowish testaceous; thorax

scarcely wider than long; legs yellowish testaceous. Length, .12–.14 inch; 3–3.5 mm. ..... **pedicellatum.**

Slightly depressed; color varying from brownish to nearly black, slightly æneous, elytra with a large, triangular subhumeral spot, and a smaller one, behind the middle, yellowish testaceous; thorax rather more than one half wider than long; legs yellowish testaceous. Length, .10–.14 inch; 2.5–3.5 mm. **quadrimaculatum.**

44. Black, slightly æneous; thorax cordate, slightly wider than long, very distinctly narrower at base than apex, basal impressions unistriate; elytra more than one-half wider than the thorax, variegated with testaceous markings along the margin; legs testaceous. Length, .10–.14 inch; 2.5–3.5 mm..... **affine.**

Piceous or nearly black, the elytra often tinged with brown, unicolorous; thorax about one-half wider than long, subcordate, slightly narrower at base than apex, basal impressions bistriate; elytra slightly wider than the thorax; legs rufo-testaceous. Length, .10–.13 inch; 2.5–3.25 mm..... ... **muscicola.**

45. Slightly elongate, moderately convex; black, often tinged with greenish, elytra with a subapical spot and the apex pale; thorax subquadrate, slightly narrower at base than apex, hind angles carinate; elytra moderately finely striate, the striæ abbreviated behind, the two inner nearly entire; legs rufo-testaceous. Length, .13–.14 inch; 3.25–3.5 mm..... **sulcatum.**

46. Thorax distinctly wider than long; elytra about one-half wider than the thorax. 47

Thorax scarcely wider than long; hind angles rectangular; convex, nigro-æneous, the elytra often brownish, deeply striato-punctate, with a subapical spot and the apex pale testaceous, legs testaceous. Length, .08–.11 inch; 2–2.75 mm..... **assimile.**

47. Hind angles of thorax acute; form slightly elongate, convex; color black, scarcely æneous, the elytra with a subapical spot and the apex more or less testaceous; basal impressions of thorax unistriate; elytra finely striato-punctate; legs piceous or rufo-piceous. Length, .13–.15 inch; 3.25–4 mm. **angulifer um.**

Hind angles of thorax rectangular; less elongate than *anguliferum*; color nearly as in that species, the elytral spots more marked; basal impressions of thorax bistriate; striæ of elytra deeper; legs rufous or pale rufo-piceous. Length, .12–.15 inch; 3–3.75 mm..... **cautum.**

48. Slightly elongate, convex; black, scarcely æneous; thorax distinctly narrower at base than apex; striæ of elytra with deep, not closely placed punctures; legs yellowish testaceous. Length, .15–.17 inch; 3.75–4.25 mm.. **semistriatum.**

49. Maxillæ with the outer lobe biarticulate; elytra with two dorsal punctures on the third striæ.

Thorax about one-half wider than long, basal impressions moderately deep; elytra oblong-ovate, slightly wider than the thorax, deeply striate, the striæ entire; form elongate, depressed; color dark rufous, the elytra varying to slate-color; legs rufous. Length, .14–.16 inch; 3.5–4 mm. **puritanum.**

Maxillæ with the outer lobe with the two joints united; mandibles long, slender, nearly straight; elytra with two dorsal punctures on the third interval.

Feebly convex; rufous or rufo-piceous; thorax slightly wider than long, dis-

tinctly narrower at base than apex, hind angles rectangular; striæ of elytra sparsely and very finely punctate; legs rufous. Length, .17–.22 inch; 4.25–5.5 mm..... **oblongulum.**

B. lævigatum *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 84.

A large and easily recognized species. By the arrangement of the dorsal punctures it recalls *semistriatum.*

Habitat: New Hampshire to South Carolina and westward to Montana and Texas.

B. nitidum *Kirby.*—Faun. Bor. Am. 1837, IV, p. 55, tab. 1, Fig. 7 (*Peryphus*).

Habitat: Canada and the more northern portions of the country from the Atlantic to the Pacific.

B. inæquale *Say.*—Journ. Ac. Phil. 1823, ser. i, III, p. 151.

In color this species is usually greenish bronze. The surface is more or less alutaceo-granulate with elevated smooth spaces.

Habitat: The eastern portions of the country, extending westward to the Rocky Mountains and Texas.

B. littorale *Oliv.*—Ent. 1790, II, p. 6, pl. i, Fig. 7 a b.

A variable species. The surface is more or less alutaceo-granulate and the color varies from bronze to nearly black. The elevated smooth spaces of the elytra vary in number and extent.

Habitat: The more northern portions of the continent from the Atlantic to the Pacific. It occurs also in Europe and Siberia.

B. carinula *Chaud.*—Rev. et Mag. Zoöl. 1868, ser. 2, XX, p. 239.

Habitat: The more northern portions of the continent from the Atlantic to the Pacific.

B. punctatostriatum *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 83.

The color is bronzed. The surface is more shining than in the last three species, and, as a consequence, the elevated smooth spaces of the elytra are feeble or nearly obsolete. The quadrate foveæ on the third interval are also less marked.

Habitat: From the Atlantic to the Pacific, extending as far south as Arkansas.

B. robusticolle *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p. 50.

Habitat: Michigan, Iowa and Kansas.

B. coxendix *Say.*—Journ. Ac. Phil. 1823, ser. i, III, p. 151.

Habitat: Illinois, Lake Superior region, Manitoba, Nebraska, Kansas, Colorado, New Mexico and Texas.

B. confusum *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p. 52.

This species has for some time been regarded as a variety of the preceding, but seems distinct by the characters above given. It is the *nitidulum* of Dejean.

Habitat: The Eastern United States, extending westward to Colorado.

B. americanum *Dej.*—Spec. 1831, V, p. 84.

This and the next four species differ from the others in which the dorsal punctures are placed on the third stria by the subangulate elytral humeri.

Habitat: The greater part of the region east of the Rocky Mountains.

B. dilatatum *Lec.*—Ann. Lyc. 1848, IV, p. 455 (*Ochthedromus*).

But two specimens are known to me. Of these one is Leconte's type, from Columbia, Pa. The other is from the Indian Territory and in Dr. Horn's collection.

B. honestum *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 82.

This has been previously known as *antiquum* Dej. It approaches the next very closely.

Habitat: Canada and the United States from the Atlantic to the Rocky Mountains and Texas.

B. chalceum *Dej.*—Spec., 1831, V, p. 88.

Habitat: The same region as the preceding, but apparently less abundant.

B. blanchardi *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p. 56.

Habitat: Lowell, Mass.

B. nigrum *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 85.

Habitat: Canada and the Eastern and Central States, extending westward to Iowa and Kansas.

B. longulum *Lec.*—Ann. Lyc. 1848, IV, p. 457 (*Ochthedromus*).

Habitat: Lake Superior region, the Rocky Mountains and California.

B. concolor *Kirby.*—Faun. Bor. Am. 1837, IV, p. 54 (*Peryphus*).

Habitat: Maine, the Lake Superior region and from thence westward to the Pacific Coast. It is essentially a northern species.

B. planatum *Lec.*—Ann. Lyc. 1848, IV, p. 456 (*Ochthedromus*).

Our largest species of *Bembidium*. In form it recalls certain species of *Platynus*.

Habitat: Lake Superior, the Rocky Mts., Nevada, Oregon, Washington and British Columbia.

B. simplex *Lec.*—List Col. N. Am. 1863, p. 14 (list name); Hayw., Trans., Am. Ent. Soc. 1897, XXIV, p. 63.

Very closely allied to the next species.

Habitat: Labrador, Canada, the Hudson Bay Territory, the White Mts. of New Hampshire, Vermont, Massachusetts, the mountains of North Carolina, the Lake Superior region and Missouri.

B. planiusculum *Mann.*—Bull. Mosc. 1843, XVI, p. 215.

Habitat: Lake Superior, the Rocky Mts. and from thence westward to the Pacific Coast and northward to Alaska. But two specimens have been seen by me from the Lake Superior region.

B. incertum *Mots.*—Bull. Mos. 1845, XVIII, p. 350 (*Notaphus*).

The dorsal punctures are larger and more prominent than in most of the species of the genus.

Habitat: Lake Superior region, the Rocky Mountains, Alaska and the Northwest.

B. grandiceps *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p 70.

The head is unusually large in this species, being scarcely narrower than the thorax.

Habitat: Massachusetts, New York, Pennsylvania, the District of Columbia and Texas. It seems to be local.

B. guexi *Chaud.*—Rev. et Mag. Zoöl. 1868, ser. 2, XX, p. 242.

Habitat: The northeastern States, extending southward to Virginia and westward to Lake Superior.

B. fugax *Lec.*—Ann. Lyc. 1848, IV, p. 467 (*Ochthedromus*).

Habitat: Canada, Vermont, Massachusetts, New York, New Jersey, Pennsylvania, Ohio, Michigan and Illinois.

B. transversale *Dej.*—Spec. 1831, V, p. 110.

A very variable species. As here constituted it includes several species that were based upon characters which become evanescent when a large series of specimens is studied.

Habitat: Gulf of the St. Lawrence, Canada, Michigan and the Lake Superior region and from thence westward to the Pacific Coast.

B. canadense *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p. 77.

This species differs from its allies in having all the striæ of the elytra entire. It most nearly resembles the western *B. striola.*

Habitat: Ottawa, Canada.

B. bimaculatum *Kirby.*—Faun. Bor. Am. 1837, IV, p. 52 (*Peryphus*).

Habitat: The more northern portions of the continent from the Atlantic to the Pacific, extending southward in the mountainous regions to Colorado and Nevada.

B. postremum *Say.*—Trans. Am. Phil. Soc. 1834, IV, p. 437.

Habitat: Massachusetts (Lowell), New York, Pennsylvania (Allegheny) and Illinois. Apparently quite local.

B. ustulatum *Linn.*—Syst. Nat. 1758, I, p. 416 (*Carabus*).

Habitat: The region east of the Rocky Mountains, Europe and Siberia.

B. lucidum *Lec.*—Ann. Lyc. 1848, IV, p. 466 (*Ochthedromus*).

It resembles the preceding very closely and may possibly prove to be merely a variety of that species.

Habitat: Hudson Bay Territory, Lake Superior region, Minnesota, Manitoba, and from thence westward to the Pacific Coast.

B. fuscicrum *Mots.*—Etud. Ent. 1855, p. 79.

Habitat: Manitoba, Montana, Wyoming, Colorado, Utah and Oregon.

B. scopulinum *Kirby.*—Faun. Bor. Am. 1837, IV, p. 53 (*Peryphus*).

A very pretty and well-marked species.

Habitat: Labrador, Canada, Manitoba and the more northern States, extending westward to Colorado.

B. picipes *Kirby.*—Faun. Bor. Am. 1837, IV, p. 54 (*Peryphus*).

Specimens rarely are seen with a submarginal pale spot. This is the form described as *plagiatum* Zimm.

Habitat: Eastern States, Lake Superior region, Minnesota, Missouri and Texas.

B. texanum *Chaud.*—Rev. et Mag. Zoöl. 1868, ser. 2, XX, p. 240.

Habitat: Iowa, Missouri, Indian Territory and Texas.

B. grapii *Gyll.*—Ins. Suec. 1827, IV, p. 403.

Habitat: Northern Europe, Greenland, the more northern portions of this continent, and high altitudes in the White Mountains of New Hampshire, the Rocky Mountains and the Sierras.

B. cordatum *Lec.*—Ann. Lyc. 1848, IV, p. 457 (*Ochthedromus*).

Habitat: New York, Missouri, Nebraska, Colorado, Indian Territory and Texas.

B. graciliforme *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p. 97.

This species has been confused with the next in collections. It is, however, more slender, and differs essentially in the form of the thorax.

Habitat: Massachusetts, Pennsylvania, Michigan, Illinois and Iowa.

B. dentellum *Thunb.*—Mus. Nat. Ac. Ups. 1785, p. 50, not 10 (*Carabus*).

In this and the preceding the markings are ill-defined.

Habitat: The northern portions of this continent and Europe.

B. versutum *Lec.*—Proc. Am. Phil. Soc. 1878, XVII, p. 594.

Habitat: New Hampshire, Massachusetts, Michigan and Wisconsin.

B. dorsale *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 84.

Habitat: The central region of the country. It seems to be most abundant in the States between the Mississippi River and the Rocky Mountains.

B. postfasciatum *Hamilton.*—Can. Ent. 1893, XXV, p. 303.

Confused in many collections with the preceding, which it resembles quite closely.

Habitat: Massachusetts, Pennsylvania, Ohio, Illinois, Iowa, Kansas and Texas.

B. viridicolle *Laferté.*—Rev. Zoöl. 1841, p. 48 (*Notaphus*).

Habitat: Massachusetts, the Central States, Manitoba and the Rocky Mountains.

B. fraternum *Lec.*—Proc. Ac. Phil. 1857, p. 6.

Habitat: Louisiana, Florida, Georgia, Virginia, Pennsylvania and Massachusetts.

B. æneicolle *Lec.*—Ann. Lyc. 1848, IV, p. 459 (*Ochthedromus*).

Habitat: Lake Superior region, Manitoba, Wyoming and Colorado.

B. variegatum *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 89.

A very variable species. As defined by me, it includes *patruele* Dej. and *conspersum* Chaud., there being apparently no constant characters for their separation.

Habitat: The greater part of the United States and Canada from the Atlantic to the Pacific.

B. nigripes *Kirby*—Faun. Bor. Am. 1837, IV, p. 57 (*Notaphus*).

Capable of but feeble distinction from the preceding. The legs are dark piceous or black, and the form is rather less elongate, while the size averages somewhat smaller.

Habitat: Anticosti and the Gulf of the St. Lawrence, the Lake Superior region, Manitoba, Alberta, the Rocky Mountains, Oregon, Washington, British Columbia and Vancouver Island.

B. intermedium *Kirby.*—Faun. Bor. Am. 1837, IV, p. 58 (*Notaphus*).

Habitat: Illinois, Manitoba, Montana, Nebraska, Kansas, Indian Territory, Mississippi, Texas, Colorado, New Mexico, Arizona and southern California.

B. timidum *Lec.*—Ann. Lyc. 1848, IV, p. 460 (*Ochthedromus*).

Habitat: Lake Superior region, Manitoba, Colorado, Utah, Nevada and along the Pacific Coast from California to British Columbia.

B. versicolor *Lec.*—Ann Lyc. 1848, IV, p. 460 (*Ochthedromus*).

Habitat: The greater part of the United States and Canada.

B. constrictum *Lec.*—Ann. Lyc. 1848, IV, p. 462 (*Ochthedromus*).

Habitat: The Atlantic Coast, extending westward to the Rocky Mountains and Texas.

B. contractum *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 85.

Closely allied to the preceding, but differs, in addition to the characters above given, by its more slender and elongate form.

Habitat: The Atlantic States from Massachusetts to Florida and westward to Ohio and Tennessee.

B. morulum *Lec.*—New Species Coleopt. 1863, pt. i, p. 19.

Habitat: Hudson Bay Territory.

B. mutatum *G. & H.*—Cat. 1868, I, p. 416.

Habitat: Hudson Bay Territory, Mt. Washington, N. H., Lake Superior region and high altitudes in the Rocky mountains.

B. pedicellatum *Lec.*—Proc. Ac. Phil. 1857, p. 6.

Habitat: Pennsylvania, District of Columbia, Maryland and Missouri. Apparently very local

B. quadrimaculatum *Linn.*—Syst. Nat. 1758, I, p. 416 (*Carabus*).

Habitat: The entire region east of the Rocky Mountains, Europe and Siberia.

B. affine *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 86.

Habitat: The Atlantic and Central States, extending southward to Florida, Texas and Arizona.

B. muscicola *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p. 122.

This species has for some time been erroneously regarded as the European *B. lampros* Hbst.

Habitat: Canada, New Hampshire, Massachusetts, Michigan and Illinois. Specimens have been seen labeled "Cal."

B. sulcatum *Lec.*—Ann. Lyc. 1848, IV, p. 463 (*Ochthedromus*).

Habitat: Canada, Hudson Bay Territory, Massachusetts, the Lake Superior region and Illinois.

B. anguliferum *Lec.*—Ann. Lyc. 1852, V, p. 185 (*Ochthedromus*).

Often confused with *cautum*, from which it is rather feebly distinct, by the characters above given.

Habitat: California, Vancouver Island, Nevada, Manitoba, Michigan, Pennsylvania, New Hampshire (Mt. Washington) and Canada.

B. cautum *Lec.*—Ann. Lyc. 1848, IV, p. 464 (*Ochthedromus*).

Habitat: Alaska, Washington, Utah, the Rocky Mountain region and Massachusetts. It has also been recorded from Mt. Washington, N. H., and from Michigan.

B. assimile *Gyll.*—Ins. Suec. 1810, II, p. 26.

Habitat: The greater part of North America and Europe.

B. semistriatum *Hald.*—Proc. Soc. Phil. 1843, I, p. 303 (*Lopha*).

Recalls *lævigatum* by the arrangement of the dorsal punctures.

Habitat: New Hampshire, Massachusetts, Pennsylvania and Kentucky.

B. puritanum *Hayw.*—Trans. Am. Ent. Ac. 1897, XXIV, p. 129.

Resembles most closely the Californian *B. laticeps*.

Habitat: Massachusetts.

B. oblongulum *Mann.* — Bull. Mosc. 1852, XXV, p. 298 (*Trechus*).

Referable to *Amerizus* Chaud., by the peculiar structure of the outer lobe of the maxillæ, were that genus allowed to stand.

Habitat: Canada, Vermont, the White Mountains of New Hampshire, Massachusetts (Lowell), Ohio, Michigan, Alaska, California and Mexico.

(*To be continued.*)

BIOLOGICAL NOTES ON SOME COLEOPTERA FROM NEW MEXICO.

By T. D. A. COCKERELL, Mesilla, N. M.

In the course of some studies of plant fauna, the following memoranda have been made. The contemplated work treating of the several plant faunæ in detail is not likely to be finshed for some years, so it may be well to offer some of the results in advance.

CHRYSOMELIDÆ.

Calligrapha serpentina *Rog.*

In Mesilla this breeds abundantly on *Sphæralcea angustifolia.* On July 20 I found one ovipositing on the under side of a leaf next to the midrib. The eggs are placed irregularly in a heap, loosely united by a viscid secretion, the majority endwise on the leaf. The egg is 2 mm. long, cylindrical, rounded at each end, pink (the color of a red raspberry, granular from the presence of innumerable closely-placed low tubercles, the extreme tips smooth and shining. Although the egg masses are very conspicuous at a short distance, they could be overlooked easily on the plant, being about the size and color of the flowers. The larvæ are gregarious on the under side of the leaf and are brown-black to dark brown, with long black hairs on which appear pale objects which, on close inspection, are seen to be the stellate hairs of the plant detached. I do not describe the larvæ further, as I sent some to Professor Wickham, who will probably describe and figure them.

Chrysomela tortuosa *Rog.*, (det. Wickh.)—On July 10 I took one at Deming on *Ephedra.*

Doryphora decemlineata *Say.*—Abundant on *Solanum elæagnifolium* in Mesilla, breeding. This species belongs to the Upper Sonoran,

not the Transition, and in New Mexico *S. elæagnifolium* is its normal food plant.

Coptocycla clavata *Fab.*, (det Wickh.)—On *Physalis* in Mesilla.

Chelymorpha argus *Licht.*, (det. Wickh.)—In August on *Solanum elæagnifolium* in Mesilla.

Colaspis flavida *Say*, (det. Wickh.)—Rather common on cultivated (mission) grape vines in Mesilla, July 22, etc.

CURCULIONIDÆ.

Trichobaris compacta *Casey*, (det. Wickh.)—Common in Mesilla on *Datura metelioides*, breeding in the stems.

Otidocephalus vittatus *Horn*, (det. Natl. Mus.)—Common on *Bigelovia graveolens*, var., Tularosa Creek, below the Mescalero Agency, October 2. The species found on *Bigelovia* in the Mesilla Valley has been referred to *O. nivosus* Casey.

SCARABÆIDÆ.

Atænius inops *Horn*, (det. Wickh.)—Flying in great numbers in a sandy place, about 5:30 P. M., beginning of October, at Las Cruces.

Cyclocephala dimidiata *Burm.*—Common at Mesilla in flowers of *Datura metelioides*. Also at Selden.

SCOLYTIDÆ.

Xylocleptes cucurbitæ *Lec.*, (det. Dep. Agr.)—Bred in the spring of 1897 in numbers from dead stems of *Cucurbita fœtidissima* (=*perennis*) in Mesilla.

LAGRIIDÆ.

Statira opacicollis *Horn.*—San Augustine, on the east side of the Organ Mountains, August 29, in great numbers in flowers of *Datura*.

BUPRESTIDÆ.

Agrilus couesii *Lec.*—Santa Fé, August 3, on *Mentzelia nuda*.

Anthaxia æneogaster *Lap.*—Ruidoso Creek, 7,500 feet, on *Rosa fendleri* (E. O. Wooton. coll.).

The dragonfly mentioned on p. 94, of the June number of the JOURNAL, as *Lestes virgo* Hagen (sp. n.) [in MS.], is, I find after examination of Hagen collection in the Museum of Comparative Zoölogy, at Cambridge, Mass., the same as *Lestes inequalis* Walsh.—Philip P. Calvert.

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AN ATTEMPT TO CLASSIFY THE HOLARCTIC LEPIDOPTERA BY MEANS OF THE SPECIALIZATION OF THE WINGS.

PART I.—THE DAY-BUTTERFLIES.

By A. Radcliffe Grote, A.M.

A. Forewings with vein IX present..... **PAPILIONIDES.**
a 1. Vein IV2 of primaries inclines to Cubitus .....PARNASSIIDÆ.
a2. Vein IV1 of forewings from Radius ..... PARNASSIINÆ.
d2. Vein IV1 of forewings from crossvein ..... THAIDINÆ.
a 1. Vein IV2 of primaries placed centrally .....PAPILIONIDÆ.
B. Forewings with vein IX wanting..... **HESPERIADES.**
b1. Radial veins on primaries not arising separately, or if separate less than five in number.
b2. Vein III4 to costa before apex.
b3. Wings not angulate.
b4. Vein IV2 not central on both wings.....PIERIDÆ.
b5. Vein III1 arising from above cell.....PIERINÆ.
b5. Vein III1 arising beyond cell.....LEPTIDIINÆ.
b2. Vein III4 to external margin below apex.....NYMPHALIDÆ.
b6. Vein II absorbed by III to junction with I on secondaries NYMPHALINÆ
b6. Vein II absorbed by III to a varying point but always before junction with I ....ARGYNNINÆ.
b2. Vein III4 to apex.
b7. Vein VIII not marked on primaries .....AGAPETIDÆ.
b8. Crossvein of secondaries joins Cubitus.....PARARGINÆ.
b8. Crossvein of secondaries joins vein IV3 .....AGAPETINÆ.
b3. Wings angulate.....LIBYTHEIDÆ.
b7. Vein VIII marked on primaries.
b9. Vein III2 beyond extremity of cell.....LIMNADIDÆ.
b9. Vein III2 before extremity of cell.....NEMEOBIIDÆ.
b4. Vein IV2 central on both wings.
b10. Vein I of hind wings developed.....RIODINIDÆ.
b10. Vein I of hind wings absent.....LYCÆNIDÆ.
b 11. Vein IV1 of primaries directly joining Radius ..... THECLINÆ.
b 11. Vein IV1 of primaries indirectly joining Radius... LYCÆNINÆ.

b1. Radial veins on primaries arising separately and five in number.
b12. Vein IV2 of primaries approaching cubitus.....MEGATHYMIDÆ.
b12. Vein IV2 of primaries placed centrally.....HESPERIADÆ.
b13. No costal vein (vein 1) on primaries.....PAMPHILINÆ.
b13. A costal vein (vein 1) on primaries.....HESPERINÆ.

The division of the Day Butterflies rests upon the presence of a strong and short downwardly curved vein at the base of primaries and joining the internal margin in the Parnassi-Papilionidæ, and its absence in all the other Day Butterflies. Whether we homologize this vein with the loop at the base of vein VII, which we call VIII, or give it a separate number the character is unaffected, for the loop runs in a contrary direction, and the opposite development of the vein in the Swallow-tails remains to be accounted for. But I cannot so homologize this peculiar vein and for several reasons. We find in *Castnia*, *Actias*, *Telea*, *Thyridopteryx*, a lower prolongation of the loop VIII. It seemed to me at one time that here might be a trace of this vein IX which would have anastomosed with VIII and finally have disappeared. But the greatest encouragement, that I might discover the phylogeny of *Papilio*, was offered me by the drawings of Mr. Meyrick in the Geometridæ. For here appeared vein VIII as a degenerate (dotted in the drawings) nervure, and, behold, IX was present likewise and indicated by a curved continuous line joining internal margin as in *Papilio*. Here I said, can I never be mistaken. This is the internal vein of the Papilionides. But when I, myself, tried to find Mr. Meyrick's vein in nature, it was not there. The pertinacity with which Mr. Meyrick repeats this vein in his drawings of the Geometrid wing leads one to suspect that he has really perceived it on some special occasion and now brings it in (*i. e.*, *Venilia macularia*) where there is no occasion. But I have small hopes.

The general resemblances, striking as they may be between the Hesperiades and Papilionides, or between *Papilio* and the rest of the Day Butterflies, might be all developed upon another line and the connection between the two would in that case be placed farther back still. Any system which places the Papilionides between the groups of the other Day Butterflies, all of which appear to me to hang more or less closely together, must first account for the fundamental neurational differences before it can be entitled to credit. The diurnal habit might be set down, with other features, to convergence.

There are two chief directions in which changes are making in the structure of the butterfly wing. The first is traceable throughout the order. Its aim is the breaking up of the system of theMedia, one

of the three primary veins. Its progress is not uniform, but is evidenced in different ways. The comparative completion of this effort affords a particular gauge of the standing of the form. The second direction occurs sporadically in very different groups. It consists in an absorption of the branches of the Radius, so that their normal number is diminished. It is probably reminiscent of what has taken place on the hind wings, as we see from *Hepialus*. When we apply our knowledge of these two tests of specialization to the Day-Butterflies, we find that the second, or sporadic direction, occurs in the Parnassidæ, Pieridæ, Lycænidæ, thus independently in otherwise very different groups. It is thus a secondary character and we find it again in a group so dissimilar to the Day Butterflies as the Saturniades, while it is not indicated in the Hawk Moths. The first or general direction of specialization we find indicated by most Lepidoptera, in some of its stages. It is a fundamental movement and has probably a mechanical cause. The Pieridæ unite the two directions in a palpable manner, more strongly so than the Lycænidæ, which exhibit, in the Theclinæ, the second direction very completely. In the Pierinæ (*Mancipium*, *Pieris*, etc.) the first direction is shown by the transfer of vein IV1, the upper branch of the Media, to the Radius. This state of affairs we find only again so strongly marked in *Nemeobius*. In the four-footed Butterflies the first direction, or suppression of the Media, asserts itself in the total degeneration of the crossvein; while the two upper branches of the Media are pulled towards the Radius, the cell opens completely. Thus the Media, as a system, ceases to exist. But in the Nymphalidæ, the upper branch of the Media does not become completely absorbed by the Radius, as in the Pieridæ, in which latter the cell is never so completely opened as in the former family. Again the *second* direction is not taken up at all by the brush-footed butterflies, the Radius remaining generalized, five-branched. Judging from the condition of the hind wings especially, the Agapetinæ and Limnadidæ are less specialized than the Nymphalidæ. The Libytheidæ overlap the more generalized Meadow-Browns. The neuration of the Libytheidæ is almost repeated by the Nemeobiidæ, which latter retain no essential wing characters of the Riodinidæ (Erycinidæ) or Lycænidæ. I tried to explain its position on the Lycænid branch by the view that the evolution of the neuration has taken a parallel direction to that of the Pieridæ and the four-footed Butterflies. On the neuration by itself we must, and I now do, exclude *Nemeobius* from the Lycænid branch. Its junction with this branch must remain

problematical. There are three patterns of the wings of Day Butterflies: the Papilionid, the Pieri-Nymphalid, the Lycæni-Hesperid. I cannot place *Nemeobius* satisfactorily because I am told it is a Lycænid while its wings are of the pattern of the Pieri-Nymphalids.

The plan of the Lycænid and Hesperid wing is identical. The first only differs from the latter, by the commencement of the absorption of the radial veins. It is, in my opinion, very improbable that the Lycænid and Hesperid wing should be separately evolved. The Lycænid wing is a continuation of the Hesperid and can be directly inferred from it. The process of absorption which divides *Lycæna* from *Hesperia*, makes a further step and produces *Thecla*. The morphological value of the stages is similar.

Although, from any limited study, the neuration appears as a whole fixed, it is not so; it has its flux, perhaps its reflux. A wider comparison brings this out already and it will bring it out more and more. The neuration has a present meaning which cannot be overlooked. To neglect or pass over its teaching, the conclusions we may derive from its variations, is to detract from the picture, to make this picture by so much an inaccurate one, of the present condition and the probable past and future of the organism. In the Lepidoptera, the veins which seem to be most stable are the main branches, the Radius and Cubitus. Perhaps the latter with its two branches is the more constant. The play is now with the Media and its system of branches. Even in so fast bound, so concrete a group as the Sphingidæ, where everything seems exhausted tending to a future development, where there is so little that is lax and pliable in any stage of the insect, the branches of the median system still shift, vein IV1 sometimes leaves the crossvein and appears attached to the Radius, while IV2 varies in its inclination to the Cubitus. So rigid and stark a neuration as we find in the Hawk Moths seems to defy the investigator and to tax his patience beyond its power. But finally even here something will be yielded to the diligent enquirer. He will be able on occasion at least to distinguish between the more generalized and the more specialized form and this through the veining of the wings. The wing of the Hawk Moths has assumed a certain stability from its meeting in a high degree the requirements of flight and holds fast to this pattern of veining in consequence.

The art of the student is exercised to seize upon what is disparate and bring these characters together into deeper harmony. No doubt, a record lies for us to read in the neuration of the wings; the difficulty lies in properly revealing it, in an adequate interpretation. What I

have called the "moving veins" appear to follow a still active law of development. Of the three primary veins, Radius, Cubitus and Media, the two main trunks have attained a certain fixity opposition through processes which have been carried on during an unmeasurable past. The criticism which our knowledge of the direction of the venation allows us of the recently published systems of classification is: that these are often founded on characters the relative value of which has not been ascertained, their recurring nature not taken into account. It is as though I had placed *Nemeobius* among the Pieridæ, because its pattern of venation demanded it, and then proceeded to erect a violent system upon such a basis after the fashion of Mr. Meyrick. But much better work will be done in working out all the variations in a single organ, endeavoring to bring out clearly the value of these variations and allowing the existing classificatory sequence, I might say the Linnéan sequence, as a rule, to stand. The work before us is still to make what is now difficult, easy. When we have reached this goal upon any point of our subject, there will arise plenty to take up the matter and display their penetration upon it further.

So we see that the principal gain from these studies is the attainment of a measure, a distinct register, of specialization. By it the groups and genera drop more naturally into their places. And these studies are critical of Mr. Meyrick's pretensions, who would arrange the Lepidoptera upon neuration but offers us a mass of incorrect figures, an impossible phylogeny and the proof positive that he has nowhere understood the movement of the veins. So, too, they reach classificators who blindly thrust the Swallowtails between the Blues and Hesperids, and they show that these also, have not even understood the conditions of the problem they assume to have solved with so much pomp of learning.

In Comstock's "Evolution and Taxonomy," to which work my indebtedness is very great, I find no distinct recognition of the two main directions of evolution in the wings as such, while there is everywhere apparent the laudable effort to correlate the changes with mechanical causes. The suppression of the Media is detailed on page 76. In this, my *first* direction, the movement of IV_2 is thus discussed: "But in which direction would one expect the base of vein V_2 to migrate? Occupying an intermediate position between radius and cubitus it may go either way. It is like a stream in the middle of a level plain, a trifle may change its course." The view taken by me is that there is a contest between Radius and Cubitus for the possession of the residue of the Media, after base and crossvein have degenerated. The two principal

veins are the residuary legatees of the branches of the Media, and the determining cause as to which shall succeed to the odd or middle branch lies in the habit of the insect in flight. The strengthening of the Radius implies a more sailing, that of the Cubitus a more hovering flight, with quicker up and down movement as in the Hawk Moths. Comstock distinctly regards the crossvein as established after base of Media has disappeared to hold the branches. I do not. The crossvein appears to me a residue which is next attacked after the base of Media has been absorbed. If the middle branch refuses to follow either Radius or Cubitus it falls away by want of a base of supply, as in *Lycæna* and *Hesperia*. (See "Evolution and Taxonomy," p. 70.) The axiom expressed by me: *The amount of the absorption is the measure of the specialization*, is intended to embody the leading principle which is to guide our pterogostic studies.* In the Pieridæ alone have I found both positions of IV2 expressed. While in *Leptidia* the position on secondaries is cubital, in all the rest of the genera it is radial. I follow Comstock's general view in considering this as here indicating dichotomy of descent and establish upon it a subfamily division.

To summarize the principal openings through which I have tried to carry the working theory of the evolution of the wings beyond what had been previously attained:

1. I try to show that the suppression of the Media is the result of a continuous movement which, after absorbing the connection of the system with the base of the wing and thoracic sources of supply, next disintegrates the crossvein and distributes the branches between Radius and Cubitus. It is probable that the crossvein is an old character, an adapted survival of a former system of crossveins.

2. That that part of the crossvein closing the cell, and lying between the median branches and either Radius or Cubitus, becomes functionally the base of the branches in their new auxiliary position after the disintegration of the central or connecting portion of the crossvein. Its former morphological character as a portion of the crossvein becomes gradually lost, the angles rounded off.

3. The absorption of the radius branches is sporadic on different lines of descent and is a reminiscent action of the absorption on the secondaries which has here already generally fully taken place and been

*The inequality of the specializing movement has been recognized by me in various places: Die Saturniden, 11, etc. The correlation of flight with the portion of the middle branch of Media is endeavored to be established by me in the "Tagfalter," etc., pp. 4 and 5.

carried to its extreme. I try to show, in pursuance of this observation, that it is questionable whether we can believe that the corresponding simplification can be attained by the Radius of the primaries, from the different position and conditions of the two wings. It is also interfered with by the absorption of IV1. This proves the absorption of the Media to have commenced after the absorption of the radial veins on secondaries.

4. I try to show that the general movement is inaugurated with the secondaries and that these show its effects more plainly than the primaries in one and the same individual. We must logically expect this to be the case from the entire course and the resulting theory of the specialization as applied to the wings, and regard it as arising from mechanical causes.

To descend to the application of these conclusions to classification, I try to show:

1. That the position assigned by Scudder and Comstock (l. c. III,) to the Swallowtails, next above the Hesperidæ, cannot be maintained in view of the pattern of the wings. The wing pattern of the Hesperiadæ and Lycænidæ is really the same and the interpolation of the Papilionidæ at this point is a violent proceeding. Far better is the position assigned to the Papilionidæ by Chapman; best of all the placing of the Parnassi-Papilionidæ, in a linear series, at the commencement of the Day Butterflies. The longitudinal vein IX on primaries, being a subprimary vein offers a subprimary character for dichotomy. The wing of *Papilio* loses its generalized characters, by a gradual process of specialization, in *Parnassius*. The Parnassi-Papilionidæ differ by a "high" character, the loss of VIII on secondaries, from all the other butterflies. They are thus comparable with the Attacinæ, the most specialized of Moths.

2. I have shown the indissoluble nature of the alliance between the Parnassiidæ and Papilionidæ and that the former are more specialized and should "head the series." The similiarity in color between the Parnassians and Pierids is adventious and secondary.

3. I have shown that the Nymphalidæ retain the radius in a generalized condition. That the higher groups alone show a perfection on on the opening of the cell, but that the upper branch of the Media is not absorbed by the Radius (as in *Mancipium*, *Pieris*, *Nemeobius*) but retains generally its position on the crossvein at the extreme upper corner of the cell. I thus show that there is small ground, from the neuration, for any supremacy of the Nymphalidæ, still less of the Agapetidæ,

or Limnadidæ, which are distinctly less specialized than the Nymphalidæ proper. So that we see that the statement of the Editor of the Philadelphia "Check List," that, in his "opinion," the Nymphalidæ are "correctly placed at the head of the Rhopalocera" is not derived from what this writer elsewhere calls "scientific knowledge" or "science," but is plainly the result of an effort to get into good company. It is characteristic also of this sort of "opinion," that when we turn to the List itself we find it to "head" with the Limnadidæ, the most generalized of the four-footed Butterflies. The success of the Nymphalid branch in attaining a variety of forms and a vast array of species has been great, and this tends to our believing it to he so dominating. It is, however, lateral, not on the main line. In the accompanying diagram the opening of the cell has led me even to give the higher groups perhaps too exalted a position, but this is a minor point. The connection of the Charaxini, a foreign group, with the main stem of the Nymphalidæ is problematical. I have commented on its position elsewhere, and it must be brought into place when the tropical butterflies are studied upon the basis here set forth.

4. It may be further assumed, that, in former periods of time, the grouping was laxer than to-day, and that the families we now are able to separate were once interconnected by forms which have dropped out. At that time the four or brush-footed butterflies may have been more nearly connected with the six-footed stem. From small and specialized groups we cannot expect the birth of new features, but from large and spreading assemblages, presenting a wide range of character. That such a state of affairs existed in the Whites, we have the testimony of *Leptidia* to prove. This butterfly appears now as an isolated survivor of what was probably a large group of Pieridæ. The abyss separating *Leptidia* from the Pierinæ is profound and I am informed that even more important deviations still exist in the family. The Pierids may then well represent the matrix from which the four-footed type proceeded.

5. Boisduval's groups of Suspensi, Succincti, Involuti, based on the fashion of fastening the chrysalis, have no existence as phylogenetic assemblages, hence are improperly used in this manner by Mr. Scudder. The Papilionid, Pierid and Lycænid Succincti have clearly reached the habit independently. It is a fallacy to believe, with Mr. Scudder, that there is a regular progression from the cocoon of the moths to a total absence of the use of silk. Instances are not rare where the generalized forms spin little or no silk and the specialized forms on the same phyloge-

netic line, make large and complex cocoons. This envelop to the pupa is so clearly an adaptive secondary character, that in one, single, upon all other characters, homogeneous group, like the Emperor Moths, the habit runs through the entire scale, from utter absence to a specialization hardly elsewhere attained, the hanging cocoons of *Philosamia*, *Attacus* and *Callosamia*. Only on paper does the sequence seen by Mr. Scudder exist. The specializations of the butterfly do not keep pace with Mr. Scudder's imaginary series, *Pieris* is more specialized than *Nymphalis*, and *Nymphalis* than *Oeneis*. The differences in the mode of attachment are brought by Mr. Scudder into an artificial connection. As to the "shrouds" of the Involuti, the utmost we can grant to Mr. Scudder is, that the mode of attachment in *Hesperia* may represent a stage by which the cocoon-making larva prepared itself to abandon this habit. To make more of the observation than this is to trifle. In a similar way the fact that in *Thais* the girdle has slipped up to the "nosehorn" may figure a stage between the Succincti and Suspensi. But *Parnassius* does not follow this lead. Among the Agapetidæ, *Oeneïs* is a generalized form. The most specialized Satyrids, I have met with, are *Pararge* and *Lasiommata*. In these vein IV_3 of the hind wings has effected its junction with the Cubitus. But in *Oeneis ællo* this junction is not attained and vein IV_3 springs still form the cross vein as in the mass of the more generalized forms. *Oeneis* belongs evidently to the genera allied to *Erebia*, in which vein I is developed, curved and running to a point. Herein it departs from *Eumenis*, in which this vein is blunt as in the Pararginæ. The character of IV_3 offered by *Oeneis* is important. It shows that this vein has not been fully absorbed by the system of the Cubitus, in this genus and the whole subfamily, Agapetinæ, to which *Oeneis* belongs. From a study of the imago, Mr. Scudder's classification is thus clearly to be rejected. The view that the Lycænid Succincti are specializations of the Papilionid is clearly an imaginary one.

6. The sequence in the above table is that recommended by me to be followed in catalogues and collections. The tribes are omitted because they are not sharply divisible. They are more or less lax groupings of allied genera near extensions of the generic idea. Each family or superfamily commences with the more specialized forms. To reverse this order in collections or catalogues is, I believe, impracticable from the nature of the objects here studied.

EXPLANATION OF DIAGRAM.

A. Papilionid stem (Papilionides) characterized by the presence on forewings of vein 'IX;' *B*, Hesperid stem (Hesperiades) characterized by the absence of the same vein. The titles of groups in *italics* denote that in these a reduction of the radial branches occurs (specialization through the *second* evolutionary movement). All the groups are arranged with regard to the specialization of the wing in the two principal directions. The *first* direction lies with the breaking up of the system of the Media and the final redistribution of the outlying three branches between the Radius and Cubitus, and this reaches a culminating point in the disintegration and disappearance of the cross vein (Nymphalinæ). In the Moths the same phenomenon is repeated in the Attacinæ (*Rothschildia, Samia, Philosamia, Callosamia, Attacus.*); IIa is the six-footed Pierid and main branch; IIb the four-footed (brush-footed) Nymphalid branch; both have the same essential wing pattern, or style of distribution of the veins and this is shared also by IIc, the Nemeobiid branch. IId is the Hesperid main branch; IIe the Lycænid specialized branch; IIf is the Hesperid generalized branch. The pattern of IId, *et seq.*, differs from the Pieri-Nymphalid branches by the simpler, more equidistant veining. The specialization, in the *first* direction, displays itself here by the disintegration of the cross-vein without a shifting of the outer branches, which latter remain *in situ.*

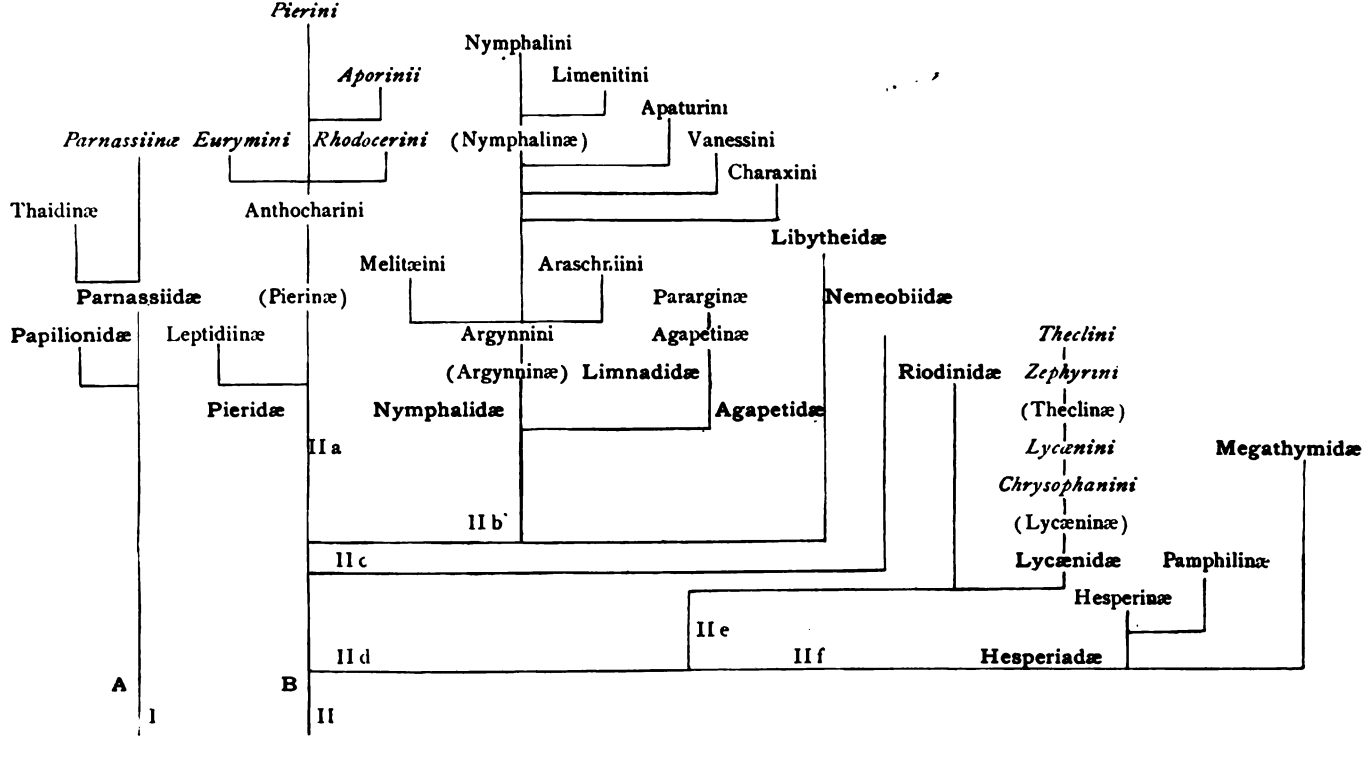
NOTES ON THE LARVA OF LAGOA PYXIDIFERA.

By HARRISON G. DYAR.

Since Abbot & Smith's work, in 1797, there has been no original reference to the larva in literature. It may be fitting that the one-hundredth anniversary of the discovery of the larva should be celebrated by a brief redescription, especially as Abbot & Smith's figure is somewhat erroneous and misleading. Their figure gives the impression of a longitudinally banded larva, whereas it is really uniformly colored. The larvæ occurred to me in some numbers at Miami, Florida.

Feet and warts, as usual in the genus, distinct; head retracted. Body slate gray; hair dense, concealing everything, regularly directed backward, soft, smooth, pale whitish gray with an under tint of darker gray which predominates narrowly along the subventral edge and in a disheveled anterior tuft above the hood. Dorsal line slightly keeled; anal hair short; no tufts. Anal plate reddish. In the earlier stages the hair is thin and fluffy, white; but the body shows through sordid whitish with a brownish dorsal band divided by a pale line and a broad brown lateral band. The spiracular glands show white. Edge of cervical shield and anal plate orange tinted. Cocoon and pupa as in *L. crispata.* Feeds on the young shoots of live oak. The larva differs from that of *L. crispata* only in color.

DIAGRAM OF THE PROPOSED DIPHYLETIC GENEALOGICAL TREE FOR THE HOLARCTIC DAY-BUTTERFLIES.



NEW SPECIES OF GEOMETRIDÆ FROM TROPICAL AMERICA.

By WILLIAM SCHAUS.

Hypnochlora olvidaria, sp. nov.

Body white. Wings white, covered with transverse striæ of a dull green, thicker in places and forming two transverse shades from the costal margin of the primaries to the inner margin of the secondaries. Expanse, 9 mm.

Habitat: Castro, Parana.

Comostola pallidaria, sp. nov.

Body yellowish white. Wings above white, thicky flecked with light green scales; fringes white, costal margin of the primaries white. A black discal point on primaries and secondaries. Underneath the wings are white. Expanse, 13 mm.

Habitat: Castro, Parana.

Racheospila arpata, sp. nov.

Head reddish. Thorax bright green. Abdomen whitish green, with a subdorsal row of reddish tufts. Wings bright green, with a reddish point, in the cells. The primaries with the outer margin purplish, wide at the inner angle, very narrow between 3 and 4, then widening slightly, and not continuing beyond 6, the fringe purplish. Secondaries with a large purplish spot, inwardly shaded with yellow at the apex; the anal angle also purplish and the fringe of the same color. Underneath greenish white, showing the markings of the upper surface. Expanse, 22 mm.

Habitat: Rio Janeiro.

Named after my friend, M. J. Arp, of Rio Janeiro.

Nemora masonaria, sp. nov.

Head brown. Thorax green. Abdomen dorsally brownish, laterally white. Wings white, thick irrorated with dark green striæ and scales; two indistinct very fine, wavy green lines cross both wings. Primaries with a small dark green discal spot. Underneath greenish white, the costal margin of the primaries finely brown. Expanse, 17 mm.

Habitat: Jalapa, Mexico.

I take pleasure in naming this species after J. T. Mason, Esq., who has kindly given me a specimen.

Aplodes fringillata, sp. nov.

Head thorax and abdomen white. Wings above bright green, the outer margins and fringes pearly white. A basal white spot on the primaries. An inner and a submarginal white line on both wings, between the latter and the extreme margin the veins are white. A white discal point on each wing. Two white spots on the inner margin of the primaries contiguous to the white lines. Underneath greenish white. Expanse, 15 mm.

Habitat: Castro, Parana.

Tachyphyle janeira, sp. nov.

Palpi white. Head, thorax and abdomen green. Wings above green, a smoky brown space occupying the base of both wings, except the costal margin of the primaries; an outer wavy dark line, heaviest on the primaries and outwardly shaded with luteous, crosses both wings, beyond which the nearly entire outer margin is black except the apex of the primaries and the anal half of the outer margin on the secondaries. A black discal point on each wing. Underneath nearly white, the outer margin of the primaries and the apex of the secondaries heavily shaded with black. A round black spot near the base of the primaries and a transverse basal black mark on the secondaries. Expanse, 31 mm.

Habitat: Rio Janeiro.

Azelina paranaria, sp. nov.

Antennæ pectinated, outer margins angular. Wings above pale reddish gray specked with black, the primaries with the space between the two lines reddish browny especially along the outer line. A round black discal spot on each wing. On the primaries the inner line extends from the costa, forming a deep curve close below the discal spot, and then two other large curves towards the inner margin, but not so deep as the first; the outer line wavy. Secondaries with only the outer line, which is nearly straight and shaded with brownish near the inner margin. Some termina, black points. Underneath the wings are greenish gray, with brown outer line finell wavy on the primaries, dentate on the secondaries, a dark annular discal spot on each wing. Expanse, 34 mm.

Habitat: Castro, Parana.

Nearest *Azelina lindigii* Feld.

Azelina jonesaria, sp. nov.

Wings very slightly dentate. Antennæ simple. Body and wings greyish brown. The primaries having the inner line wavy and oblique from the costa to the median at the origin of vein 2; the line recommences again at the median nearer the base, and forms an angle at the submedian. This line is outwardly shaded with very dark brown. The outer line is parallel with the outer margin, very slightly wavy with a deep indentation on the submedian vein. This line is inwardly shaded with rich brown, outwardly outlined finely with buff which is followed by a broad grayish shade, beyond which the margin is buff with a subterminal brownish shade. A terminal row of spots. The discal spot consisting of two small velvety brown contiguous spots one above the other and sometimes forming a line. Secondaries grayish brown. A submarginal buff line inwardly shaded with darker brown. Underneath dark fawn color, irrorated with black scales. A black discal point on the secondaries. An outer dentate whitish line. Expanse, 31 mm.

The ♀ differs in having the medial costal space of the primaries more light reddish brown, and the general ground color of the wings more of a gray. The terminal spots are yellow. Underneath the outer line is more angular and shaded with dark brown. Expanse, 34 mm.

Habitat: Castro, Parana.

Semiothisa paranaria, sp. nov.

Primaries excavated below apex. Secondaries with angle. Body and wings creamy buff, thinly speckled with brown. On the primaries a basal curved line light olive brown. An inner wavy brown shade on both wings followed on the primaries by another wavy olive brown shade. A minute cluster of brown scales at the origin of vein 2. An olive brown streak at the end of the cell. On the secondaries a black discal point. A broad greenish gray outer shade on both wings, narrowing near the apex on the primaries and cut by a brownish streak. The fringe buff except in the excavation below the apex where it is dark olive brown. Underneath yellowish buff with the markings as above, but the outer shade is more in the appearance of a band interrupted by the veins which are yellow. A whitish patch at the apex of the primaries. Expanse, 26 mm.

Habitat: Castro, Parana.

Semiothisa masonata, sp. nov.

Primaries with apex rounded and then excavated. Secondaries with an angle. Wings lilacine brown, the outer margin somewhat darker; the basal line slightly curved, fine brown. The inner line fine, nearly straight and contiguous on the primaries to a dark brown spot on the costal margin. The outer line first curved, then nearly straight till the secondaries, where it is very wavy, fine, brown, outwardly shaded with buff. Beyond the outer line a brown costal spot on the primaries, also a cluster of brown scales between veins 3 and 4. A black discal point on secondaries. Underneath yellowish, irrorated with brown. The basal and inner lines more heavily marked, the outer line very fine and followed by a more distinct brown line which is nearly straight and is outwardly rather heavily shaded with brown. Expanse, 26 mm.

Habitat: Jalapa, Mexico.

Epione cinerea, sp. nov.

Body and wings silvery brown gray, irrorated with black and white scales. Veins pale, distinct; an outer row of black points on the veins, connected by a fine brownish line, crosses both wings. The primaries with an indistinct white inner line, and a large black discal point, a subapical reddish brown shade. Underneath the markings less distinct, and the anterior portion of the outer line shaded with brown. A black discal point on the secondaries. Expanse, 28 mm.

Habitat: Rio Jalapa.

Acrosemia ochrolaria, sp. nov.

Head and thorax reddish. Abdomen yellowish brown. Wings reddish, both crossed by a wavy brown line, outwardly shaded with gray, which starts from a subapical gray spot on the costa of the primaries. A terminal brownish gray line partly dentate on the primaries, and forming a row of spots on the secondaries. A black discal point on each wing. On the primaries an inner transverse line, slightly curved, brown, inwardly shaded with gray. Underneath the wings are buff, the transverse lines smoky and most apparent on primaries. Expanse, 28 mm.

Habitat: Jalapa, Mexico.

Boarmia cariaria, sp. nov.

Pale grayish fawn color irrorated with dark striæ and specks, a basal curved black line not reaching the costal margin, a subbasal dark shade from the costa to the submedian vein; the median shade outwardly curved below the costa, and marked with a series of black points on each vein; this shade is closely followed by the outer line which is black and also marked with black points on each vein; beyond the outer line an indistinct brownish shade, and a subterminal wavy white line. On the secondaries the median shade and outer line are widely separated. A brownish spot at the end of the cell on both wings. Underneath the wings are yellowish white; on the primaries a terminal black shade widest at the apex, which is itself white; the costal margin of the primaries yellowish with fine black striæ. Expanse, 38 mm.

Habitat: Peru.

Described from a long series showing no variations, the species is closely allied to *B. roccaria* Obt.

Boarmia orizabaria, sp. nov.

Body gray. Wings white, thinly irrorated with black specks; the veins on the outer half of the wings yellow; some yellow shades at the base; the basal line fine, black; the median shade and outer lines black, indistinct on the primaries; on the secondaries the median shade is formed of two parallel bands and more conspicuous, the outer line is fine and well marked; a yellow shade follows the outer line on both wings; the apical portion of the primaries is blackish crossed by a wavy white subterminal line, the apex itself being gray. A broad subterminal black band on the secondaries. A large black spot in the cells. Underneath white; a black spot in each cell; a large black space on the apical portion of the primaries, leaving the apex white. On the secondaries, a few black marks on the outer margin below the apex. Expanse, 37 mm.

Habitat: Orizaba, Mexico.

This species is very distinct from any described form known to me. I possess a ♂ also quite similar but in poor condition.

Boarmia dukinfieldia, sp. nov.

Body gray; a black transverse line on the basal segment of the abdomen. Wings whitish, thickly irrorated with brownish scales, especially beyond the outer line. The basal line velvety black, very conspicuous; the median shade consisting of a fine brownish line rather indistinct except on the inner margin of the secondaries. A dark brown point in the cell; the outer line black, dentate and wavy, followed on the primaries at vein 4 by a dark shade extending towards the outer margin; the outer line followed by two brownish bands; a subterminal whitish wavy line on the primaries, the extreme margin distinctly outlined in black, the fringe white, spotted with black at the end of veins. Underneath the wings are dark gray, especially along the margins, and are crossed by an outer line marked with dark points in the veins. Expanse, 35 mm.

Habitat: Castro, Parana.

Boarmia sapulena, sp. nov.

♂ fawn color, thickly irrorated with brownish scales especially on the outer half of the wings, the basal line fine, blackish, indistinct; the median shade, dark, broad, indistinct, suffused with the ground color, the outer line fine, wavy, black, followed by a light brownish shade; an ill-defined smoky terminal band, divided by a semilunular white line. Abdomen with two dorsal rows of black spots. Underneath wings sordid white, faintly irrorated with brownish scales, and a faint dark subapical shade on the primaries and the discal spots indistinct. Expanse, 31 mm.

♀ Fawn color, thickly irrorated with brownish scales, no lines visible. A broad transverse median shade and the outer line replaced by a series of black points on the veins, followed by a faint browish shade. The discal spots very indistinct. Expanse, 42 mm.

Habitat: Petropolis, Rio Janeiro, San Paulo.

Boarmia luciaria, sp. nov.

Thorax brown. Abdomen gray. Primaries dark brown with the median space between the basal and outer lines light gray, these two lines black, well defined; a faint median brownish line, the discal spots brownish, circular, with grayish centre; an indistinct subterminal dentate blackish line inwardly powdered with grayish scales. Secondaries with the basal half light gray, crossed by a faint brownish median line, the outer line black, distinct; the marginal half dark brown with an indistinct subterminal grayish shade. A terminal row of black points. Underneath the wings are whitish at the base and then heavily shaded with black. Expanse, 32 mm.

Habitat: St. Lucia, B. W. I.

Boarmia aztecaria, sp. nov.

Head and thorax gray. Abdomen somewhat paler. Wings semi-diaphanous, whitish gray, slightly irrorated with darker gray and blackish striæ. Primaries with the base somewhat brownish; the basal line velvety black, oblique from costa to median, then slightly curved inwardly to the submedian and afterwards very oblique inwardly towards the base of the inner margin; a broad blackish sinuate median line extending on to the secondaries, where it curves down along the inner margin; the outer line velvety black and fine, starting from the costa at four-fifths from the base, obliquely curved to vein 5, where it shoots out a short black line towards the outer margin, and then wavy and sinuate to the middle of the inner margin, just above which it touches the median line; on the secondaries a wavy black outer line. The extreme margin finely black. The discal spots small and faintly marked. Underneath white, showing the markings of the upper side. Expanse, 42 mm.

Habitat: Orizaba and Oaxaca, Mexico.

A very fine and distinct species.

Boarmia franckia, sp. nov.

Wings fawn color irrorated with black scales, thickly so on the basal and median spaces. The basal and outer lines fine, black and parallel, very oblique outwards from the costa, and then angled and inwardly oblique to the inner margin;

the outer line followed on both wings by a brown band: the median shade dark, very dentate on the primaries; the discal spots small, black; on the outer margin some diffuse brown and whitish shades; the extreme margin finely black. Underneath pale fawn color irrorated with grayish scales; an indistinct outer row of points on the veins. Expanse, 39 mm.

Habitat: Castro, Parana.

Boarmia nebularia, sp. nov.

Wings pale fawn color, thickly irrorated with pale brownish scales; the lines very indistinct and represented rather by shades and heavier suffusion of scales; the outer line semilunular on the primaries, straight on the secondaries; a subterminal row of dark spots, more noticeable on the secondaries; a terminal row of black points. Underneath the wings are pale fawn color, thinly irrorated with brownish scales; a black point in the cells and a broad subterminal dark shade. Expanse, 35 mm.

Habitat: Petropolis, S. Brazil.

The sexes are quite similar.

ON THE TWO SPECIES OF EUDÆMONIA.

PLATES XI–XII.

BY WILLIAM BEUTENMULLER.

Several examples of *E. brachyura* and *E. argiphontes* and their larvæ, from Sierra Leone, Africa, are in the collection of Old World Heterocera of William Schaus, Esq., which was recently donated by him to the American Museum of Natural History.

Eudæmonia brachyura (Plate XI) is pink, with the spots yellowish. The larva is deep black on the upper side with the extreme sides broken with yellowish, and the under side wholly yellowish (possibly green in life). Anal plate with the two thorny spines, cervical shield and head testaceous. Along each side of the body are three rows of spines with branches of shorter spinules, on the anterior edge of the cervical shield are four short spines. Length 33 mm. August 21, 1895. *E. argiphontes* (Plate XII) is brown with pinkish shades and a dark transverse band across each wing. The larva is yellowish (probably green in life), mottled with black along the sides, cervical shield, lateral row of spines and those on 1, 2, 3, 11 and 12 segments black. Remaining rows of spines yellow (green) tipped with black, with the spinules also tipped with black. On each side of the segments 3 and 4 is a black band broken on the dorsum by the ground color. Thoracic feet brown. Length 37 mm., July.

THE LIFE-HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—XII.

PLATE IX, FIGS. 1–10.

BY HARRISON G. DYAR, A M., Ph.D.

Apoda biguttata *Packard.*

1864—*Limacodes biguttata* PACKARD, Proc. Ent. Soc. Phil. III, 341.
1865—*Limacodes tetraspilaris* WALKER, Cat. Brit. Mus. XXXII, 486.
1874—*Limacodes biguttata* STRETCH, Zyg. & Bomb. N. A. pl. 8, fig. 16.
1882—*Limacodes biguttata* GROTE, Check List.
1892—*Apoda biguttata* KIRBY, Cat. Lep. Het. I, p. 553.
1894—*Apoda biguttata* NEUMOGEN & DYAR, Journ. N. Y. Ent. Soc. II, 73.

LARVA.

1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 221 (as *A. y-inversa*).

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space broad, narrowing slightly toward the extremities, ending behind in the broadly quadrate joint 13, not strongly arched. Lateral space broad, oblique, scarcely concave, narrowing a little toward the extremities. Subventral space small, contracted. Ridges at first prominent and tubercular, setiferous, later smooth, granular, the subdorsal ridge formed only by the change in slope between back and sides. Setæ of Stage I single, on the thorax ia–iib and iv, on abdomen i–iii converted into tapering spines with expanded trifid tips, the upper two on joints 4–12 united into a single spine of which one seta forms a knot-like prominence on the other, exactly as in *A. y-inversa*. These setæ lean in alternating directions. Later the warts are represented by short setæ, normal in number, not united together; in the last stage almost entirely absent. Depressed spaces fairly well developed, small, but not very sharply defined, but all present (1)–(8). Skin at first smooth, later with secondary spines on the tubercles and conical granules, finally uniformly covered with round clear granules. After the last molt the specific white coloring definitely appears, of the same general character as *A. y-inversa*. There are six or seven stages. In the former case the stage before the last as here described is omitted.

AFFINITIES, HABITS, ETC.

This larva does not differ structurally from *A. y-inversa* with which it is strictly congeneric, and the same remarks will apply to both species. (See Journ. N. Y. Ent. Soc. III, 152.) In color it is the same whitish

green as its ally, but differs in the absence of the transverse yellow line on joint 3.

The eggs are laid singly on the lower branches of the oak, its only food plant. The larvæ feed in Stage I eating the parenchyma from below in little patches. The moths emerge at the end of June, my examples all appearing between the 25th and 29th of that month. The males separate from the females before morning and are not found in copulation during the day. The species is single brooded, mature larvæ occurring in the middle of August and into September.

This is the larva originally described by me as *A. y-inversa.* (See Journ. N. Y. Ent. Soc. III, 153 and V, 2.) I found them rarely at Plattsburgh, Clinton Co., and on Esopus Island in the Hudson River opposite Hyde Park, Dutchess Co. They were unusually abundant at Bellport, Long Island, in the summer of 1896 and I bred them in some numbers with the kind assistance of Mr. L. H. Joutel, who kept the cocoons over winter for me.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, rather opaque whitish, white on both glass and leaf; 1.2 x .7 mm. Reticulations very small and obscure, irregularly quadrangular. They hatch in 7 to 8 days.

Stage I. (Plate IX, fig. 1.)—Distinctly segmented, opaquish white, the spines whiter. Rounded and narrowed behind, truncate before, highest in front. Dorsal and lateral spaces moderate, flat, not hollowed; ridges slight. No marks except a large black spot on the head, which consists of a patch of pigment below the skin of joint 2 and is visible even to the naked eye. Head smoky, especially on the vertex, the sutures of clypeus black; mouth brown, a pale area around it. When retracted, the head looks black. Setæ long, slender with broadened bases, tapering, the subdorsal row of joints 4–12 with distinct side prongs, one-third the length of the other limb. Tips enlarged and cleft. Basal two-thirds of seta milky white, apex transparent, smooth, becoming black. On joint 3 five setæ, the same on joint 4 but the upper two consolidated. The lateral seta of joint 5 leans upward and the subdorsals of joints 5, 7, 9 and 11 lean outward, alternating with the others. Two simple subdorsal setæ on joint 13. Skin smooth, slightly shining. Later the larva is very shiny, a hollow appears above the base of each subdorsal tubercle in the dorsal space and a distinct white line under the skin along subdorsal and lateral ridges. Spines no longer conspicuously white. Length .9–1.5 mm. The larvæ feed in this stage. Duration about 5 days.

Stage II. (Plate IX, fig. 2.)—Blunt, squarish, highest at joints 5–6. Pale green, a whitish line along subdorsal ridge, a little wavy. Subdorsal tubercles on joints 3–13 and middle ones on joints 3 and 4 conical, clear, with two black setæ each; lateral row on joints 3–12 with one seta, all with small, short, colorless, secondary setæ with blunt tips. Skin with sparse watery granules (Plate IX, fig. 6). Largest depressed spaces indicated. The primary setæ are conic and sharp tipped, the secondary ones bulbous. The dorsal space appears as a dark green band from the food showing by transparency. Length 1.5 to 2.5 mm.

Stage III.—Thickly conic, clear granular, otherwise as before. The dorsal depressed spaces show faintly as whitish dots. Subdorsal line more distinct, nearly straight; lateral tubercles setose. Head about .4 mm. wide, whitish, eye black, mouth brown. Length 2.4–3.5 mm. Duration 4 days.

Stage IV.—Elliptical with square tail. Dorsal space flat; lateral concave, subventral, short. Subdorsal ridge slight, lateral one well marked. No subdorsal tubercles, setæ arising from the ridge, two dark stiff ones on each segment with no secondary setæ. On the lateral ridge, low raised tubercles with some secondary setæ. Skin densely clear granular, the granules slightly conic. Color green, a yellow line along the subdorsal ridge on joints 3–13, not joining each other at either end. A distinct dorsal row (with dark centers) and a fainter lateral row of whitish intersegmental dots. Head .5 mm. wide, pale, eye black. Later the ad-dorsal depressed spaces are indicated, and a darker green shade appears above and below the subdorsal line. Length 3.5–4.6 mm.

Stage V.—Ridges even, not tubercular; skin densely clear granular, the granules large, conic, especially large along the lateral ridge, but no longer setiform. Setæ of both ridges black, arising from the ridge. Dorsal (1), addorsal (2), small ones below the ridge (3), large lateral (4), upper segmental (5) and lower inter-segmental (6) white dots, the two largest (1) and (4), dark centered, all these areas smoother than the skin between, lacking the granules in a small space, not much deepened, the edges graded and obscure. Body elliptical, tail quadrate, notched on the sides. Dorsal, and upper half of lateral space pigmented, green; below this transparent leaf green; a broad yellow subdorsal line on joints 3–13, dark edged above and below. The larva looks much smoother than before. Length 4.5–6.5 mm.

Stage VI.—Head about 1.3 mm., green, eye black. Body smooth, no setæ perceptible with a lens except the two pale ones of subventral row

(iv and v) which look long. Skin densely clear granular, the granules large, coarse, conic as before, but less sharply pointed and situated more closely along the lateral ridge. Tail quadrate, slightly laterally notched. Color whitish green, a broad yellow line along the subdorsal ridge, very slightly waved, edged with dark green as before. A faint white line along subventral edge. All the depressed spaces (1) to (6) indicated by yellowish dots, small, shallow, only (1) with a rather sharp edge and fine granular bottom, the others nearly covered by the large bordering granules. Subventral space very finely granular. Spiracles round, whitish, normal, in line. Later the color becomes gradually whiter, the subdorsal lines approach each other at the ends, but are separated by a space of .5 mm. No transverse line on joint 3. Length 6.3–9.5 mm. Duration of the stage 8 days.

Stage VII.—(Plate IX, fig. 8). Shape as described above. Skin closely clear granular, frosted. Whitish green, clearer on joints 3–5; broad subdorsal lines pale yellow, edged with dark green above and less distinctly so below; an obscure whitish subventral line. Subdorsal lines free at the ends. Depressed spaces whitish, not contrasting, (1) and (4) faintly dark centered. Granules rounded, not conic as before; not contiguous, but the sides a little angularly adapted to each other. Depressed spaces very small, the smallest, as (2), covered over by the granules which are a little smaller there than elsewhere. Space (1) a small elliptical smooth area. Setæ inperceptible. The shape is as in *A. y-inversa* except that the lateral ridge is more prominent, exceeding the subventral ridge. Length 9.5–12 mm.* Duration of the stage 7 days.

Cocoon and pupa as usual.

Food-plants.—Oak. Usually on *Q. alba*, less commonly on other oaks.

EXPLANATION OF PLATE IX.

Fig. 1. Larva in stage I, dorsal view, enlarged × 60.
" 2. Larva in stage II, side view, enlarged × 30.
" 3. Larva in stage VII, front view, enlarged.
" 4. The same, side view.
" 5. Moth of *Apoda biguttata*, natural size.
" 6. Granules of stage II, enlarged.
" 7. Larva in stage VII, early in the stage, dorsal view.
" 8. Larva in stage VII, mature.
" 9. Granules of stage V enlarged, from area of subdorsal ridge.
" 10. The same, stage VI.

* A larva with six stages had the following lengths: I, .9–1.5 mm., II, 1.5–2.4 mm., III, 2.4–3.6 mm., IV, 3.6–5.5 mm., V, 5.5–8.4 mm, VI, 8.0–11.2 mm.

DIPTERA FROM THE LOWER RIO GRANDE OR TAMAULIPAN REGION OF TEXAS.—I.

By C. H. Tyler Townsend.

The present paper is the first of a series to be published on the dipterous fauna of the region of the Lower Rio Grande, in Texas and Tamaulipas. The material described was collected by the writer, principally near Brownsville, Texas, while engaged as Field Agent of the Division of Entomology, of the U. S. Department of Agriculture.

The writer has already published, in the Transactions of the Texas Academy of Science, i, pp. 71 to 96, a paper on biogeography, which includes mention of the Lower Rio Grande district. This district forms a part of the *Tamaulipan* fauna, which may be recognized as extending from the Nueces river region in Texas to the central or southern part of the Mexican State of Vera Cruz. Several months' collecting done by the writer in the Lower Rio Nautla region of the State of Veracruz, since the above paper on biogeography was published, has shown that that locality must come within the limits of the *Tamaulipan* fauna, as possessing many temperate forms of insects. A considerable number of these temperate forms may range as far south as the Coatyocoalcos river, or even farther.

It is pointed out in the above mentioned paper that at best the insect fauna of Lower Rio Grande, from an examination of some 500 species of Coleoptera and Diptera, shows somewhat less than twenty-five per cent. of *Neotropical* forms. Probably the percentage will run lower on the examination of a greater mass of material. The district is mainly *Lower Sonoran;* but there is, beside the *Neotropical* (*Mexican* province of the *tropical transition* zone), a considerable element of *Austroriparian*, and even a few *Upper Sonoran* forms reach down to it from the west, while a maritime *Antillean* fauna reaches up the Mexican coast line and keys to Padre Island. The fauna of this district is therefore rich in forms, as particularly evidenced by the Coleoptera so far collected, for no less than five great life provinces tend here to meet and intermix their constituent elements to a greater or less extent.

For the determinations of the flowers on which the diptera mentioned in this paper were taken, I am indebted to Dr. J. M. Coulter and Mr. F. V. Coville.

SIMULIIDÆ.

Simulium tamaulipense, sp. nov.

♀. Length, 1½ mm. Near *S. meridionale*, but smaller and the outer one on

each side of the three thoracic lines not curved outward at posterior end. Eyes velvet black, face and front silvery; the front with usually a trace of a linear black vitta in one specimen very distinct, in another entirely wanting. Antennæ yellowish, with a silvery covering Thorax silvery, with three longitudinal lines; the middle one longest, very narrow and linear; the outer ones heavier, straight, slightly divergent posteriorly. Looked at from directly above, the outer lines appear curved, outwardly convex. Scutellum and metascutum below scutellum, both brownish in some lights, but in others they seem to be wholly silvery, the various portions appearing different in color to the view at the same time. Abdomen silvery, but the third and fourth segments wholly brownish, sometimes with a round median silvery spot on each. Legs yellowish, shaded with silvery, tarsi blackish or brownish; hind metatarsi yellowish, except at distal end. Wings clear, whitish, veins dilute pale yellowish. Halteres and wing bases pale dilute yellowish.

Four ♀'s, Reynosa, Tamaulipas. A small species taken on car windows of railway train, May 10th.

Described from four dried specimens.

SYRPHIDÆ.

Baccha clavata *Fab.*

One ♂ bred from pupa found in square of cotton at Carmen, about four miles up the river from Brownsville, May 24th. The pupa was fastened by its anal end to the inside of the square. It may be described as follows:

Pupa.—Length, 5⅔ mm. Pale greenish yellowish. Oval with a flat ventral surface, full and rounded on anterior end, more tapering and pointed on posterior end. A few short hair-like filaments of in, tegument on dorsal surface in five transverse rows, the first row being on anterior end above cephalic plate.

The adult was found issued May 31st. Facial stripe greenish black. Thorax dark metallic greenish. Scutellum greenish across the disk. Posterior border to the insertion of the antennæ dark greenish. Otherwise the coloring was normal.

Baccha tropicalis, sp. nov.

♂. Length, nearly or quite 12 mm. Eyes of a beautiful soft yellowish-olive color, frontal triangle rust-yellow except sides which are pale greenish-yellow, with a round or slightly oval black spot anteriorly near basis of antennæ, and a pointed spot before posterior angle. Front with thin black hair. Antennæ rust-yellow, the third joint with a brownish tinge, arista same color as third joint. Face pale greenish yellow. Ocellar area soft deep black, a brassy-yellowish space behind it between eyes. Occiput gray-cinereous. Thorax on the sides, and scutellum, the same color as the whole pluræ, bright clear yellow with hardly a greenish tinge, the scutellum and posterior sides of thorax with slightly more of a greenish or olivaceous tinge. Pectus

with a slight rosy tinge to the yellow. Disk of thorax abruptly rust-yellowish brown; with a narrow black vitta near border on each side, interrupted at suture and bordered on inside with a rust-yellow margin, but on outside with a hardly perceptible one between the vitta itself and the rust-yellowish brown line belonging to the ground color; in the middle with a pair of narrow uninterrupted vittæ, both narrowly margined inside and out with rust-yellow. Semicircular area below scutellum blackish, yellowish next scutellum. First segment of abdomen almost wholly yellow with a greenish tinge. (N. B.—The above description was made from fresh specimens just captured. What follows is drawn from dried specimens.) The colors change somewhat in dried specimens. Two broad blackish vittæ often appear on mesoscutum after specimens have become dried. The semicircular area of metathorax below scutellum is divided into two crescent-like portions, the lower one and lower half of upper being brown, and the rest yellowish. Abdomen yellowish-red or reddish-yellow, but I believe it is more of a rust-yellowish in fresh specimens, and certainly much lighter; first segment broad, lunate, with yellowish hairs; hind border of each segment darker, also base of second segment same except extreme base which is yellowish. Third, fourth and fifth segments with a median pair of narrow, closely approximated, longitudinal, parallel, brown lines. Legs yellow, the distal half of hind tibiæ brownish. Anterior-basal half of wings yellowish, extending on outer border distally to end of third costal cell, inner border of yellow thence extending back somewhat irregularly to middle or basal third of anal cell, except that it runs down the inner border of apical cell inside of spurious vein; inner-apical half, or rest of wing, dilute fuscous, the centers of the two posterior, anal, discal and submarginal cells being dilute or sub-clear. A wrinkle in distal end of second basal cell, extending into discal cell; three whitish spots in transverse line, one on proximal end of this wrinkle, one on spurious vein which is here slightly enlarged, and one opposite in marginal cell. Halteres yellowish, with a brownish tinge on knobs.

♀. Length, 11 mm. Differs from ♂ as follows: Eyes not contiguous. Rust yellowish of front extending back nearly to ocellar area, a narrow median blackish vitta on its posterior half. Posterior portion of front brassy-yellowish, narrowly enclosing ocellar area in front. Wings with the yellow as in ♂, but with no fuscous except at end of submarginal cell, very narrowly in end of marginal, on vein at distal end of anal cell, and faintly on small cross-vein. Abdomen with the two median lines on third to fifth segments heavier, with slightly oblique more or less faint brown lines on sides, and with lateral edges of third to sixth segments brown. Second segment pale brownish with a broad yellowish curved anteriorly convex fascia across middle. The ♀ has the abdomen wider than the ♂.

Nineteen specimens, as follows: One ♂ and two ♀ 's, Brownsville, June 21. Taken on flowers of *Clematis drummondii* Torr. & Gray, and *Monarda clinopodioides* Gray. Nine ♂ 's and five ♀ 's, Brownsville, June 22. Taken on flowers of *Clematis drummondii*. Also one ♂ not on flowers. One ♂, Roch's Resaca, about three miles up the river from Brownsville, June 25. On flowers of *Clematis drummondii*, in opening of heavy timber—big trees with hanging moss.

Belongs to the neotropical group of *phætoptera* Schin., *livida*

Schin., *flavipennis* Wied., etc., which occurs from Brazil to the tropical portions of Mexico.

Volucella esuriens, var. **mexicana** *Mcq.*

Brownsville, April 7. Ramirez and San Miguel, Tamaulipas, on the Matamoras and Monterey Railway, May 10th; and same date numbers seen hovering constantly about a large wood pile of well-seasoned mesquite near La Mesa, a wood stop west of Ramirez. They were probably seeking an opportunity to oviposit where their grubs could find longicorn larvæ on hatching from the egg.

San Tomas, about seven miles down the river from Brownsville, June 7. At this date this species was found extremely numerous in the palmetto thicket at San Tomas, but always flying high up amongst the tops of the palmetto (*Sabal mexicana*) moving very swiftly, and in such numbers making altogether a noise like a swarm of bees.

Brownsville; June 23. Two ♂'s and two ♀'s taken on flowers of *Gaillardia pulchella* Fong. Also taken up to July 14th.

Point Isabel, Texas, on the coast, June 29. One ♂ taken on flower of a composite near beach. This species ranges from the Texas and Mexican coast line at sea level to the table lands of the Northwest, reaching the top of San Francisco mountain in Arizona, nearly 13,000 ft. above the sea. It thus extends from the tropical to the boreal life-zones, which is an exceptionally wide range and one not often attained.

Eristalis furcatus *Wied.*

One ♂, Brownsville, June 24, on foliage. This species may be distinguished by its velvety black vittate thorax.

The present specimen has the spots on each side of second and third segments very distinct, of good size, and yellow, with a faint tinge of reddish brown on the hinder pair. There is no trace of the median whitish spot near the hind margin of second segment. Schiner (Nov. Reise, 362) has pointed out that this whitish spot is not visible in the ♂; the third and fourth segments have each a pair of metallic shining spots, separated by the median velvety black, which unites the anterior median triangular velvety black spot with posterior marginal fascia of the same color. The pale golden pile of frontal triangle is mixed with black pile posteriorly. Antennæ brownish yellow. Length, 9 mm.

This is a tropical species, ranging from Rio Janeiro and Argentina to tropical Mexico. It has been taken at an altitude of 6,000 feet at Amula in the mountains of Guerrero (Williston, Biol. C. A. Dipt., III, p. 62).

Eristalis tricolor *Jaenn.*

Thirty-three ♂'s and eight ♀'s, as follows: San Tomas, one ♂ June 16, and one ♀ June 23, in palmetto jungle. Brownsville, six ♂'s and one ♀ taken on flowers of *Lippia lanceolata* Michx, June 22; one ♂ taken on flowers of *Gaillardia pulchella* Fong, June 23; twenty-four ♂'s and six ♀'s taken on flowers of *Lippia lanceolata*, June 24; and one ♂, June 28.

The ♂ taken June 16 shows a very faint line of brown on posterior half of edge of second abdominal segment, and a still fainter trace on third segment. Face silvery-white, with whitish-brassy pile. Front a little cinereous, with longer hair of same color as that on face. Antennæ brownish yellow. Front and middle knees yellowish, extending half way down tibiæ, the rest of middle tibiæ yellowish brown, only the extreme proximal end of hind tibiæ yellowish. Wings very faintly flavous tinged on antero-basal position. Length, 10½ mm.

The other specimens measure from 8 to 11 mm. in length. They are all quite constant in abdominal coloration. All the ♀'s, however, and a very few of the ♂'s, show gradations to a variation (♀ of June 22) in which the black thoracic band is rather deeply invaded anteriorly in the middle by the cinereous, and also has an arcuate border of cinereous behind next the scutellum and entending to wing bases on each side. This makes the thorax wholly cinereous excepting a pronounced lunate band of black before hind margin, with its concavity forward. The scutellum is yellow as in other specimens.

Eristalis vinetorum *Fab.*

Brownsville, June 1, two specimens, ♂, ♀. One ♂ on flowers of *Verbesina encelioides* Benth & Hook., June 18. One ♂ on flowers of *Monarda clinopodioides* Gray, and two ♂'s on flowers of *Lippia lanceolata* Michx., June 22. Three ♂'s and four ♀'s taken on flowers of *Gaillardia pulchella* Fong. Also ♂, ♀, July 3. San Tomas, four ♂'s June 9 and 23, in palmetto jungle.

Length, 11 to 13 mm. All agree closely with Williston's description, except that the fourth abdominal segment in his specimens was a little retracted, thus hiding the opaque black transverse fascia on anterior border.

CONOPIDÆ.

Zodion albonotatum, sp. nov.

Two specimens; one, Brownsville, June 24; the other, woods back of Fort Brown, July 3. Both taken on flowers of *Lippia lanceolata* Michx.

Length, 7–8 mm. Differs from all described species by the whitish markings of the thorax. Face, cheeks and front light yellowish, covered with a silvery-white bloom; a little less than posterior half of front abruptly velvety dark brown or blackish, the anterior portion of front being more yellowish than the face. Antennæ brown, the tip of second joint often with a yellowish tinge, and the third joint with a reddish-brown tinge. Occiput fuscous or blackish, with some thin blackish hairs. Thorax and scutellum soft velvety brownish-black, with a medain pair of rather closely approximated ashy-whitish vittæ extending little more than half way or at most two-thirds way to scutellum, and with silvery-whitish pollinose spots as follows: A round one on humeri, a transversely elongate one just back of humeri cleft and widened below and notched anteriorly; the whole posterior border of scutellum, widest in the middle; and two rather rounded spots, forming really one longitudinally elongate marking but divided by a suture, immediately in front of each lateral corner of scutellum. First abdominal segment soft brownish-black, with a few black hairs on sides; second segment black on basal half on sides, but on only front border in middle, and with a pair of transversely elongate narrowly coalesced oval black spots near hind margin, the rest of middle portion of segment being of a shade between fuscous and golden yellow, the posterior half of sides broadly deep golden-yellow, pollinose continued narrowly along hind border, the black of anterior lateral angles of segment with a patch of black hairs; third segment wholly deep golden yellow pollinose, except a pair of large sub-lunate black spots rather deeply notched on outside, widened behind, reaching anterior margin, coalesced anteriorly, separated posteriorly by a golden-yellow median line running half way to front border, narrow hind border of whole segment golden-yellow; fourth and fifth segments wholly deep golden-yellow, except a pair of well-separated median black spots near hind margin, those on fourth segment being of good size, those on fifth small and dot-like; sixth segment wholly deep golden-yellow; two segments composing anus blackish, with a silvery sheen. Legs blackish brown, the whole with a considerable silvery sheen especially the under sides of tibiæ which are more yellowish, pulvilli and claws except the tips yellowish. Wings a little fuscous, the antero-basal half yellow. Halteres pale-yellowish. The black of abdomen has a slight olive tinge; and in old specimens the deep golden-yellow pollen sometimes becomes greased, and shows then only a blackish color.

TACHINIDÆ.

Ocyptera euchenor *Walk.*

Eleven specimens, Brownsville, as follows: One ♂, June 22, on flowers of *Lippia lanceolata* Michx. The front in this specimen was not fully developed, indicating recent issuance from pupa. Six ♂'s and four ♀'s, June 24, also on flowers of *Lippia lanceolata.*

Length of ♂'s 8–9 mm.; of ♀'s 8½–9 mm. Although there is only one millimeter difference in the length of the ♂'s, there is a marked difference in their comparative size and stoutness. Nearly all of the specimens have the prevailing color of the abdomen red, but one ♀ has it more black than red. Most of the specimens, including all

the ♀'s, have the tip of abdomen distinctly blackish, but several ♂'s have it more or less reddish.

Giglio-Tos makes this species a queried synonym of *O. dosiades* Walk. The specimens which I originally referred to *O. euchenor* (Pr. Ent. Soc. Wash., 1891) varied in length from 8–10 mm.; while those I referred to *O. dosiades* were not only much shorter, but proportionately much smaller in size, so that it seemed hardly probable that all belonged to one species. I am aware that size may be of no importance as a specific character, and since I have more recently found specimens of all gradations in size between the two forms, so that it was impossible to separate them into two series, I am inclined to believe in their identity. I advocate, however, the use of the name *euchenor*, instead of *dosiades* as used by Giglio-Tos, and this for the reason that the description of *euchenor* better applies to the normal specimens. Were we to take the name that comes first in the pagination of Walker's List, we would have to employ *epytus*, which is manifestly only a synonym of *euchenor*.

Jurinia apicifera *Walk.*

Eight specimens, Brownsville, as follows: Two, ♂, ♀, June 21; one ♂, June 22, and four ♀'s, June 24, taken on flowers of *Lippia lanceolata* Michx.; and one ♂, June 28. Length, 11½–14 mm.

The species which I have always recognized as *apicifera* Walk. may be distinguished by the following characters: The front (except vitta), thorax and scutellum are characteristically brassy-yellowish (sometimes grayish-brassy) pollinose; the abdomen is shining black, the fourth segment being conspicuously silvery (or grayish-ashy) pollinose.

One of the specimens above mentioned (♂, June 24), in which the thorax and scutellum have become greased, shows the ground color of the disc of thorax to be opaque black, while the humeri and lateral margins are tawny-yellowish, and the whole scutellum is brownish-yellow.

This species has the frontal vitta of a soft brick-yellow, sometimes ocher-yellow. The occiput is clothed with brassy-yellow hair of the same tinge as the pollen of thorax, sides of front, and scutellum. The whole face, including sides of face and usually most of cheeks, in these Brownsville specimens is pure silvery-white; while in northern specimens from Michigan it is usually very distinctly golden. I have already remarked on this peculiarity of difference between northern and southern specimens (Tr. Am. Ent. Soc., XXII, p. 70). There are four narrow

blackish vittæ on the thorax, all sub-equally separated from each other, the median pair being linear and more abbreviated behind than the others, which are more interrupted at the suture and curved inward behind. The hypopygium of the ♂'s is more or less reddish. The brassy pollen of thorax extends downward over the whole pleuræ, and on the underside of the front femora, in both sexes. The front tarsi of ♀ do not seem to be dilated. The scutellum bears three strong posteriorly appressed marginal bristles on each side, of which the middle one is the shortest; a short and weaker also appressed strongly decussate X-like pair in the middle on margin; and a shorter but sub-erect and straight pair immediately in front of the decussate ones. In the other points given by Williston (Trans. Am. Ent. Soc., 1888, p. 300), the specimens agree.

LOCALITY AND FOOD PLANT CATALOGUE OF MEXICAN COCCIDÆ.

By C. H. Tyler Townsend.

The following is a complete list, with full localities, distribution, and food plants, of all the scale insects so far identified from Mexico. The number, which in 1893 was but 18, now reaches 80, including varieties, and four species found at Brownsville, Texas, which must surely occur near Matamoros. The new species mentioned, have been described by Professor Cockerell in the Canadian Entomologist, Vol. XXIX, p. 265, who has recently worked up the last lot of material collected for the Department of Agriculture. That portion of the material collected between April 24 and May 10, 1896, in Yucatan, Campeche and Laguna, was secured while on a trip for the Department. The determinations of all the species of my own collecting have been made by Mr. Pergande and Professor Cockerell. Mr. Pergand determined most of the well-known species, while Professor Cockerell worked up new and less known forms.

Llaveia axinus *Llave.* (*a*) Halfway between Salina Cruz and Tehuantepec (Oaxaca). On unknown prickly bush, May 29, 1896. Coll. Towns. (*b*) Tlacotalpam (Vera Cruz). On *Jatropha* sp., and *Spondias* sp. Coll. by Llave.

Peculiar to Mexico. "I believe the genus *Llaveia* will prove to be identical with *Ortonia*, from Ecuador and Guatemala" (Ckll.).

Llaveia axinus, var. **dorsalis** Dugés. Mexico (exact locality not known to me). Coll. Dugés.

Peculiar to Mexico.

Icerya purchasi *Mark.* (*a*) Guaymas (Sonora). On orange, Sept. 23, 1894. Coll. Towns. (*b*) Hermosillo (Sonora). On orange, Sept. 25, 1894. Coll. Towns. (*c*) Magdalena (Sonora). On orange and lime, Sept. 26, 1894. Coll. Towns. (*d*) Victoria (Tamaulipas). On orange, Oct. 16, 1894. Coll. Towns. (*e*) Monterey (Nuevo Leon). On orange, Oct. 17, 1894. Coll. Towns.

Known elsewhere in California, Florida, Australia, New Zealand, South Africa, Sandwich Islands.

Icerya montserratensis *R. & H.* Izamal (Yucatan). On orange, April 28, 1896. Coll. Towns.

Known elsewhere in Montserrat Trinidad, Grenada.

Icerya pa meri *R. & H.* Guaymas (Sonora). On grape. Coll. Palmer.

Peculiar to Mexico. This species was described from cast larval skins, and may prove to be identical with some species more recently described.

Coccus cacti *L.* Southern Mexico. Formerly cultivated on *Opuntia*, in parts of southern Mexico, Oaxaca, Guerrero, etc.

Known elsewhere in Madeira, Canary Islands, Algeria, Spain, India, etc., where it was introduced for cultivation long ago. Also occurs in Jamaica.

Coccus tomentosus *Lam.* Guanajuato and Silao (Guanaj.) On *Opuntia* sp. Coll. Dugés.

Peculiar to Mexico.

Coccus confusus *Ckll.* var. La Puerta Rancho (Tamaulipas). In masses on *Opuntia* sp., May 6, 1895. Coll. Towns.

Known elsewhere in Texas, New Mexico, Arizona, Colorado. "The specimens are larger than the normal *confusus*" (Ckll.)

Capulinia sallei *Sign.* Mexico (exact locality unknown). On plant called "*capulino.*" Coll. Sallé probably.

Peculiar to Mexico.

Conchaspis angræci, var. **hibisci** *Ckll.* Tampico (Tamaulipas). On *Malvaviscus arboreus* called "*tulipan,*" October 14, 1894. Coll. Towns.

Peculiar to Mexico. The typical *C. angræci* is known only from Jamaica and Trinidad.

Conchaspis newsteadi *Ckll.* (sp. n.) Vera Cruz (Vera Cruz). On frangipanni, Feb. 26, 1896. Coll. Towns.

Peculiar to Mexico. "Surprising discovery! Three species of the genus are now known; *angræci* in Jamaica on an orchid (Hope Gardens), with the variety *hibisci* collected by Townsend in Tampico; another not yet published, found by Green in Ceylon; and now the third, this one found by Townsend in Vera Cruz. What the native country of the genus is, I know not. It may be oriental. I called this species after Mr. Newstead because he gave a very good illustrated account of the genus (as *Pseudinglisia*) only a few months after I published it." (Ckll.)

Eriococcus dubius *Ckll.*—Valles (Tamaulipas). On unknown plant, Oct. 13, 1894. Coll. Towns.

Peculiar to Mexico.

Phenacoccus yuccæ *Coq.* (*a*) Tlaltizapam (Morelos). On lime, Oct. 7, 1894. Coll. Towns. (*b*) Mexico (D. F.). On banana in sheltered patio, Dec. 27, 1892. On *Yucca* sp., probably *Y. filifera*, Oct. 8, 1894. Both coll. Towns. (*c*) Guadalajara (Jalisco). On orange, *Agave* sp., banana, *Yucca* sp., *Colocasia* sp., Oct. 9 and 10, 1894. Coll. Towns. (*d*) Agnas calientes (A. C.). On *Pelargonium* sp., *Amaryllis* sp., Oct. 11, 1894. Coll. Towns. (*e*) San Luis Potosi (S. L. P.). On orange, lime, cherimoya, *Lantana* sp., pomegranate, *Tacoma stans*, a malvaceous tree, and a caprifoliaceous shrub, Oct. 12, 1894. Coll. Towns. (*f*) Tampico (Tamaulipas). On orange, Oct. 14, 1894. Coll. Towns. (*g*) Las Esteros (Tamaulipas). On *Mimosa* sp., Oct. 15, 1894. Coll. Towns. (*h*) Monterey (Nuevo Leon). On fig, Oct. 17, 1894. Coll Towns. (*i*) Campeche (Camp.). On *Tecoma stans*, April 25, 1896. Coll Towns. (*j*) Progreso (Yucatan). On fig, May 16, 1896. Coll. Towns. Jalapa (Veracruz). On orange, May 19, 1896. Coll. Towns.

Peculiar to Mexico and California.

Phenacoccus helianthi *Ckll.* var. Northern Tamaulipas (probably). Occurs in Lower Rio Grande Valley. On cotton at Santa Maria, Texas, May 7, 1895. Coll. Towns.

Peculiar to Lower Rio Grande Valley. The typical form is found in southern New Mexico on sunflower.

Dactylopius citri *Boisd.* (*a*) Orizaba and (*b*) Cordova (Vera Cruz). On coffee. Coll. Segura. (*c*) Uruapan, (*d*) Ario, (*e*) Cuicatlan, (*f*) Jacona, (*g*) Tacambaro (Michoacan). On coffee. Coll. Segura.

Known elsewhere in eastern United States, Florida, Jamaica, Trinidad.

Dactylopius virgatus *Ckll.* Northern Tamaulipas (probably). Occurs in the Lower Rio Grande Valley. On *Cereus princeps*, guava, and *Abutilon holosericeum*, at Brownsville, Texas, June 1 to 17, 1895. Coll. Towns.

Known elsewhere only in Jamaica.

Dactylopius nipæ *Mask.* Jicaltepec (Vera Cruz). On guava, July 19, 1896. Coll. Towns.

Known elsewhere only in Demerara and Trinidad.

Dactylopius olivaceus *Ckll.* Cindad Porfirio Diaz (Coahuila). In cavities in leaves of *Yucca australis*, Nov. 25, 1894. Coll. Towns.

Peculiar to Mexico (so far as known, but doubtless occurs in Texas).

Dactylopius sonorensis *Ckll.* San Ignacio (Sonora). *Hymenoclea monogyra*, called "*gecota.*" Sept. 26, 1894. Coll. Towns.

Peculiar to Mexico.

Orthezia insignis *Dougl.* var. (*a*) Guadalajara (Jalisco). On orange, Oct. 9 and 10, 1894. Coll. Towns. (*b*) Agnas Calientes (A. C.). On lime, and (accidentally) tomato. Oct. 11, 1894. Coll. Towns. (*c*) Izamal (Yucatan). On chile, *Capsicum* sp., May 14, 1896. Coll. Towns. This may be either the true form or the variety. (*d*) Vera Cruz (Vera Cruz). Plant not given. May 7, 1893. Coll. Ckll. (*e*) Guanajuato (Guan.). Coll. Dugés.

Known elsewhere (typical form) in Jamaica, Trinidad, Antigua, Demerara, Ceylon.

Lecaniodiaspis radiatus *Ckll.* (sp. n.) Near Salina Cruz (Oaxaca). On plant resembling *Equisetum*, May 29, 1896. Coll. Towns.

Peculiar to Mexico. "This is the first record of the genus from Mexico. The species belongs in the subgenus *Prosopophora*, and is closely allied to others of the genus" (Ckll.).

Asterolecanium pustulans *Ckll.* (*a*) Pacific Coast of Mexico (locality unknown). On climbing plant. Coll. Craw, on plants entering port of San Francisco. (*b*) Vera Cruz (Vera Cruz). On potted plant, May 7, 1893. Coll. Ckll.

Known elsewhere in Florida, Jamaica, Montserrat, Antigua, Anguilla, Grenada, Demerara, Brazil, Sandwich Islands.

Tachardia mexicana *Comst.* Tampico (Tamaulipas). On *Mimosa* sp. Collector unknown; material found by Comstock in Museum Comparative Zoölogy.

Peculiar to Mexico.

Tachardia larreæ *Comst.* Northern Sonora (probably). On *Larrea tridentata*. Recorded by Comstock as occurring in southern Arizona and Mexico.

Peculiar to the *Larrea* region of southwestern Arizona and northern Sonora. *Tachardia* is a *Neotropical* genus entering the United States only in Arizona and New Mexico (and probably Texas).

Lichtensia lutea *Ckll.* Vera Cruz (Vera Cruz). On *Croton* sp., May 7, 1893. Coll. Ckll.

Peculiar to Mexico.

Pulvinaria camellicola *Sign.* (?). Tehuantepec City (Oaxaca). On *Ficus* sp., May 26, 1896. Coll. Towns.

Known elsewhere in Europe, New Zealand. As Professor Cockerell did not see these specimens they may be the same as his *P. simulans*.

Pulvinaria simulans *Ckll.* var. Northern Tamaulipas (probably). Occurs in the lower Rio Grande Valley. On a cultivated caprifoliaceous shrub at Brownsville, June 1, 1895. Coll. Towns.

Known elsewhere only in Georgia.

Pulvinaria simulans *Ckll.* Monterey (Nuevo Leon). On "fitolaca," which is another name for avocado pear, Oct. 17, 1894; and Oct. 1, 1895. Both coll. Towns.

Known elsewhere only in Trinidad (Port of Spain). Professor Cockerell says: "Nearer the Trinidad type, from which it hardly differs, than the Brownsville insect. It has 7-jointed antennæ, 3d joint longest, the rest subequal, 6 a little shorter, 2 a little longer than 1. Tarsal digitules filiform, digitules of claw short, bulbous at base, and with very large knobs."

Ceroplastodes niveus *Ckll.* Montezuma (Chihuahua). On spiny shrub, May 12, 1893. Coll. Ckll.

Peculiar to Mexico.

Ceroplastes irregularis *Ckll.* Montezuma (Chihuahua). On *Atriplex canescens*, May 12, 1893. Coll. Ckll.

Peculiar to Chihuahua and southern New Mexico.

Ceroplastes cistudiformis *Towns & Ckll.* Guanajuato (Guan.). On *Bignonia* sp. and *Chrysanthemum* sp. Coll. Dugés.

Peculiar to Mexico. Very near to *C. psidii*, Chav. which occurs in Brazil.

Ceroplastes cirripediformis *Comst.* (?) San Rafael (Vera Cruz). On *Castilloa elastica* (rubber tree), March 6, 1896.* Coll. Towns.

Known elsewhere in Jamaica, Florida.

Ceroplastes floridensis *Comst.* Balantam (Yucatan). On *Ficus* sp., May 10, 1896. Coll. Towns.

Known elsewhere in Florida, Louisiana, Jamaica, Barbadoes.

Ceroplastes mexicanus *Ckll.* (*a*) Guaymas (Sonora). On *Tecoma stans*, Sept. 24, 1894. Coll. Towns. (*b*) San Luis Potosi (S. L. P.). On *Tecoma stans*, Oct. 12, 1894. Coll. Towns. (*c*) Tehuantepec City (Oaxaca). On *Ficus* sp., May 26, 1896. Coll. Towns.

Peculiar to Mexico.

Ceroplastes ceriferus *Anders.* Cuantla (Morelos). On *Malvaviscus arboreus*, Oct. 7, 1894. Coll. Towns.

Known elsewhere in India, Japan, Australia, Antigua, probably Brazil. This determination was made by Professor Cockerell, who then considered the following species to be identical with *ceriferus*. It may, therefore, be the same form as the following, which was determined by Mr. Pergande, who holds the two to be distinct.

Ceroplastes dugesii *Towns.* (?) (*a*) San Rafael (Vera Cruz). On large tree with red bark, called "*chaco*" and "*palo mulato*," Feb. 29, 1896. Coll. Towns. (*b*) Guanajuato (Guan.). On *Malvaviscus arboreus* and *M. acerifolius*. Coll. Dugés.

Peculiar to Mexico.

Lecanium hemisphæricum *Targ.* Laguna, on Carmen Island (Campeche). On caprifoliaceous shrub (?), April 24, 1896. Coll. Towns.

Known elsewhere in Jamaica, Trinidad, Antigua, Montserrat, Pennsylvania, California, New Zealand, Australia, Europe.

Lecanium hesperidum *Linn.* (*a*) Tampico (Tamaulipas). On orange, Oct. 14, 1894. Coll. Towns. (*b*) San Luis Potosi (S. L. P.). On lime, Oct. 12, 1894. Coll. Towns. (*c*) Monterey (Nuevo Leon). On avocado pear, Oct. 17, 1894. Coll. Towns. (*d*) Chihuahua (Chih.). On orange in sheltered patios, Oct. 19, 1894. Coll. Towns.

* I think this is a mistake made at the Dept. If I am not mistaken, I took this on avocado pear.—C. H. T. T.

(*e*) Nuevo Laredo (Tamaulipas). On guava and rose, Dec. 13, 1894. Coll. Towns. (*f*) Matamoros (Tamaulipas). On orange, June 1, 1895. Coll. Towns. (*g*) Izamal (Yucatan). On orange, April 28, 1896. Coll. Towns. (*h*) Vera Cruz (Vera Cruz). On rose, May 7, 1893. Coll. Ckll.

Known elsewhere in Europe, New York, Ohio, District Columbia, Georgia, Florida, Texas (Brownsville and Corpus Christi, Coll. Towns.), Utah, California, Jamaica, Trinidad, Sandwich Islands, Chili, New Zealand, Australia, South Africa. Concerning the material collected at Izamal, Yucatan, Prof. Cockerell says: "Is this species to all appearances, but material hardly adequate."

Lecanium oleæ *Bern.* (*a*) Agnas Calientes (A. C.). On oleander, *Pelargonium* sp. and plant called "*marguerita*," Oct. 11, 1894. Coll. Towns. (*b*) San Luis Potosi (S. L. P.). On orange, lime and *Tecoma stans*, Oct. 12, 1894. Coll. Towns. (*c*) Las Esteros (Tamaulipas). On *Mimosa* sp., Oct. 15, 1894. Coll. Towns. (*d*) Monterey (Nuevo Leon). On fig, Oct. 17, 1894. Coll. Towns. (*e*) Nuevo Laredo (Tamaulipas). On guava, Dec. 13, 1894. Coll. Towns.

Known elsewhere in Jamaica, Antigua, Trinidad, Florida, South Carolina, Texas (Brownsville and Corpus Christi, Coll. Towns.), California, Sandwich Islands, Japan, France, Australia, New Zealand.

Lecanium terminaliæ *Ckll.* Vera Cruz (Vera Cruz). On liliaceous plant, May 7, 1893. Coll. Ckll.

Known elsewhere only in Jamaica.

Lecanium schini *Ckll.* Guanajuato State. On *Schinus molle*. Coll. Dugés.

Peculiar to Mexico.

Lecanium imbricatum *Ckll.* Alta Mira (Tamaulipas). On *Mimosa* sp., Oct. 15, 1894. Coll. Towns.

Peculiar to Tamaulipas and the Lower Rio Grande Valley. Several specimens were found by me on cotton at San Tomas, near Brownsville, Texas, April 5, 1895.

Lecanium sallei *Sign.* Mexico (no exact locality). Plant unknown. Coll. Sallé.

Peculiar to Mexico.

Lecanium chilaspidis *Ckll.* (sp. n.). Tehuantepec City (Oaxaca). on *Chilaspis linearis*, May 26, 1896. Coll. Towns.

Peculiar to Mexico. This is a large species "Belongs to a typically *neotropical* series, and is a very distinct species" (*Ckll.*).

Lecanium perditum *Ckll.* (n. sp.). Xcolak (Yucatan). On *Ficus* sp., May 10, 1896. Coll. Towns.

Peculiar to Mexico. Professor Cockerell says: "This is a most interesting species, and must go in *Eulecanium*, a subgenus heretofore confined to the *Holarctic* region. It is very close in many respects to *L. antennatum*, Signoret, of the northeastern United States (on oak). At the same time, it indicates an approach from *Eulecanium* to the *neotropical* forms *L. batatæ*, Ckll. (Antigua, on roots of sweet potato), and *L. baccharidis*, Ckll. (Brazil, on *Baccharis*), two species, the relationships of which had heretofore been wholly obscure."

Lecanium, sp. n. (?) San Luis Potosi (S. L. P.). On pods of *Tecoma stans*, Oct. 12, 1894. Coll. Towns.

Peculiar to Mexico.

Leconopsis dugesii *Sign.* Mexico (probably Guanajuato). Plant unknown. Coll. Dugés.

Peculiar to Mexico.

Aspidiotus rapax *Comst.* Northern Tamaulipas (probably). Found in great numbers on oleander at Point Isabel, Texas, June 8, 1895. Coll. Towns.

Known elsewhere in Florida, New Mexico, California, Antigua.

Aspidiotus tricolor *Ckll.* (sp. n.). Near Salini Cruz (Oaxaca). On shrub not identified, May 29, 1896. Coll. Towns.

Peculiar to Mexico. "Very near to *A. rapax*, Comst., and *A. ulmi*, W. G. Johnson, but seems distinct. The three species constitute a little group. *A. ulmi* is from Illinois" (Ckll.).

Aspidiotus nerii *Bouche.* (*a*) Chihuahua (Chih.). On oleander, rose, olive, and tree called "*palo dulce*," Oct. 19, 1894. Coll. Towns. (*b*) Aguas Calientes (A. C.). On oleander and shrub called "*trueño*," Oct. 11, 1894. Coll. Towns. (*c*) San Luis Potosi (S. L. P.). on "*trueño*," Oct. 12, 1894. Coll. Towns. (*d*) Guadalajara (Jalisco). On *Yucca* sp., Oct. 9, 1894. Coll. Towns. (*e*) Matamoros (Tamaulipas). On *Melia azedarac*, June 6, 1895. Coll. Towns.

Known elsewhere in eastern United States, California, Honolulu, Australia.

Aspidiotus crawii *Ckll.* (sp. n.). Mexico (locality not known). On twigs said by owner to be sarsaparilla, but which are pronounced by both Craw and Cockerell to be grape vine. Coll. Craw on plants entering port of San Francisco.

Peculiar to Mexico. "Closely allied to *A. cydoniæ*, Comst." (Ckll.).

Aspidiotus perseæ *Comst.* Mazatlan (Sinaloa). On cocoanut palm. Coll. A. de Cima.

Known elsewhere only in Florida. "Attention should be drawn to the singular occurrence of Florida coccids on the Pacific coast of Mexico, the same not being found on the east slope so far as we know. The species are *Aspidiotus perseæ*, *Pseudoparlatoria parlatorioides* and *Comstockiella sabalis*—the last, however, represented by a variety, *mexicana*. So also to *Aspidiotus personatus* on the west slope and apparently not on the east slope, but common in the West Indies" (Ckll.).

Aspidiotus reniformis *Ckll.* (sp. n.). Tehuantepec City (Oaxaca). On leaves of *Ficus* sp., May 26, 1896. Coll. Towns.

Peculiar to Mexico. "Nearest to *A. perseæ*, Comst., but very distinct" (Ckll.).

Aspidiotus townsendi *Ckll.* Cindad Porfiro Diaz (Coahuila). On leaves of shade tree in plaza, Nov. 17, 1894. Coll. Towns.

Peculiar to Mexico (and probably Texas).

Aspidiotus nigropunctatus *Ckll.* San Luis Potosi (S. L. P.). On "*trueño*," Oct. 12, 1894. Coll. Towns.

Peculiar to Mexico.

Aspidiotus yuccæ *Ckll.* Cindad Porfirio Diaz (Coahuila), On *Yucca australis*, Nov. 25, 1894. Coll. Towns.

Peculiar to Mexico (and probably Texas).

Aspidiotus ficus *Ashm.* (*a*) Tampico (Tamaulipas). On orange and tangerine, Oct. 14, 1894. Coll. Towns.—(*b*) Chihuahua (Chih.). On "polo dulce," Oct. 19, 1894. Coll. Towns. (*c*) Matamoros (Tamaulipas). On orange, Dec. 9, 1894. Coll. Towns. (*d*) Laguna, on Carmen Island (Campeche). On orange and oleander, April 24, 1896. Coll. Towns. (*e*) Vera Cruz (Vera Cruz). On rose, May 7, 1893. Coll. Ckll.

Known elsewhere in Florida, Cuba, Jamaica, Texas (Brownsville, Coll. Towns.), Australia, Ceylon, Japan.

Aspidiotus scutiformis *Ckll.* (*a*) Victoria (Tamaulipas). On orange, Oct. 16, 1894. Coll. Towns. (*b*) Monterey (Nuevo Leon). On orange and pomegranate, Oct. 17, 1894. Coll. Towns. (*c*) Soledad (Vera Cruz). On avocado pear probably, May 8, 1893. Coll. Ckll.

Peculiar to Mexico.

Aspidiotus articulatus *Morg.* (*a*) Tampico (Tamaulipas.) On

orange, Oct. 14, 1896. Coll. Towns. (*b*) San Rafael (Vera Cruz). On orange, June 14, 1896. Coll. Towns. (*c*) Laguna, on Carmen Island (Campeche). On orange, April 24, 1896. Coll. Towns. (*d*) Izamal (Yucatan). On orange and cocoanut palm (on nuts), April 28, 1896. Coll. Towns. (*e*) Balantam (Yucatan). On *Ficus* sp., May 10, 1896. Coll. Towns. (*f*) Vera Cruz (Vera Cruz). On rose, May 7, 1893. Coll. Ckll.

Known elsewhere in Jamaica, Barbadoes, Nevis, Trinidad, Demerara.

Aspidiotus personatus *Comst.* Acapulco (Guerrero). On cocoanut palm. Coll. Craw on plants entering port of San Francisco.

Known elsewhere in Cuba, Jamaica, Barbadoes, Demerara. "It is singular that this species, so common in the West Indies, but seemingly wanting on the Gulf coast of Mexico, should now turn up on the Pacific side" (Ckll.).

Aspidiotus mimosæ *Comst.* Tampico (Tamaulipas). On *Mimosa* sp. Collector unknown; material found by Comstock in Museum Comparative Zoölogy.

Peculiar to Mexico.

Aspidiotus (sp. incert. off.) **perniciosus** *Comst.* Northern Tamaulipas (probably). Occurs abundantly in Lower Rio Grade Valley. On *Fraxinus viridis* var., at Brownsville, Texas, April to May 31, 1895. Coll. Towns.

Peculiar to Lower Rio Grande Valley. *A. perniciosus* is known in California, New Mexico, Florida, Virginia, eastern Maryland, Australia. "Does not look like *perniciosus* outwardly and surely must be distinct. though the microscopic characters of the ♀ agree so far as I can see" (Ckll.).

Aspidiotus, sp. nov. San Luis Potosi (S. L. P.). On avocado pear, Oct. 12, 1894. Coll. Towns.

Peculiar to Mexico.

Aspidiotus, sp. nov. (?). Hermosillo (Sonora). On tree called "*bagote,*" probably *Parkinsonia* sp., Sept. 25, 1894. Coll. Towns.

Peculiar to Mexico.

Aspidiotus, sp. nov. (?). Monterey (Nuevo Leon). On rose, Oct. 17, 1894. Coll. Towns.

Peculiar to Mexico.

Aspidiotus, sp. nov. (?). Tehuantepec city (Oaxaca). On *Chilaspis linearis,* May 26, 1896. Coll. Towns.

Peculiar to Mexico.

Comstockiella sabalis, var. **mexicana** *Ckll.* Mazatlan (Sinaloa). On palms supposed to have come from this vicinity. Coll. Craw on plants entering port of San Francisco.

Peculiar to Mexico. The typical form, *C. sabalis* Comst., is known only from Florida.

Diaspis persimilis *Ckll.* (sp. nov.). Laguna, on Carmen Island. (Campache). On fruit of "*chicosapote,*" April 24, 1896. Coll. Towns.

Peculiar to Mexico. "So near to *D. amygdali* (*lanatus*) that I had at first a notion treat it as a geographichal race. Very interesting discovery, scientifically and economically" (Ckll.). *D. amigdali* is known in Jamaica, Grand Cayman, Santo Domingo, Barbadoes, Antigua, Martinique, Trinidad, Florida, Georgia, District of Columbia, California, Japan, Hong Kong, Ceylon, Australia, Cape Colony.

Diaspis cacti, var. **opuntiæ** *Ckll.* Xcolak (Yucatan). On *Opuntia* sp., May 10, 1896. Coll. Towns.

Known elsewhere only in Kingston, Jamaica. The variety *opuntiæcola* Newst., is found in British Guiana; while the typical form *D. cacti* Comst., is a native of Arizona and New Mexico, but has been recently reported by Maskell to occur in India.

Aulacaspis rosæ Bouch. Chihuahua (Chih.). On rose, Oct. 19, 1894. Coll. Towns.

Known elsewhere in eastern United States, Europe, Jamaica, Demerara, California, Central America, Sandwich Islands, China, Australia, New Zealand.

Aulacaspis boisduvalii *Sign.* Alta Mira (Tamaulipas). On *Bromelia pinguin,* Oct. 15, 1894. Coll. Towns.

Known elsewhere in Jamaica, Barbaboes, Trinidad.

Pseudoparlatoria parlatorioides *Comst.* Acapulco (Guerrero). On cocoanut palm. Coll. Craw on plants entering port of San Francisco.

Known elsewhere only in Florida.

Parlatoria pergandei *Comst.* Matamoros (Tamaulipas). On orange, June 1, 1895. Coll. Towns.

Known elsewhere in Texas (Brownsville. Coll. Towns.), Florida.

Mytilaspis citricola *Pack.* or sp. nov. Tehauntepec City (Oaxaca). On *Chilaspis linearis,* May 26, 1896. Coll. Towns.

Known elsewhere (*M. citricola*) in Florida, California, Tahiti, Trinidad. "*Mytilaspis* sp. with the general appearance of *citricola,*

material inadequate. If it is not *citricola*, it certainly is not any of the known Mexican species. The group to which it belongs is a very critical one, and one must have good material" (Ckll.).

Mytilaspis gloverii *Pack.* (*a*) Tampico (Tamaulipas). On orange, Oct. 14, 1894. Coll. Towns. (*b*) Matamoros (Tamaulipas). On orange, Dec. 9, 1894, and June 1, 1895. Coll. Towns. (*c*) Laguna, on Carmen Island (Campeche). On orange, April 24, 1896. Coll. Towns. (*d*) Izamal (Yucatan). On orange, April 28, 1896. Coll. Towns. (*e*) Jalapa (Vera Cruz). On orange, May 19, 1896. Coll. Towns.

Known elsewhere in Louisiana, Florida, south Europe, Texas (Brownsville. Coll. Towns.), Bolivia (La Paz), California, Japan, Ceylon.

Mytilaspis philococcus *Ckll.* Guanajuato (Guan.). On cactus. Coll. Dugés.

Peculiar to Mexico.

Mytilaspis carinata *Ckll.* Acapulco (Guerrero). On "plants like *Anthurium*." Coll. Craw on plants entering port of San Francisco.

Peculiar to Mexico.

Howardia biclavis *Comst.* Southern Mexico. On lime. Coll. Craw on plants entering port of San Francisco.

Known elsewhere in Tahiti, Trinidad, Sandwich Islands, Ceylon.

Chionaspis citri *Comst.* (*a*) Tamipico (Tamaulipas). On orange and tangerine, Oct. 14, 1894. Coll. Towns. (*b*) San Rafael (Vera Cruz). On orange, June 19, 1896. Coll. Towns. (*c*) Laguna, on Carman Island (Campeche). On orange, April 24, 1896. Coll. Towns. (*d*) Izamal (Yucatan). On orange, April 28, 1896. Coll. Towns.

Known elsewhere in Louisiana, Cuba, Bermuda, Antigua, Trinidad, Demerara, Australia, New Zealand, Tonga, Japan, Samoa.

Chionaspis furfurus, var. **ulmi** *Ckll.* Northern Tamaulipas (probably). Occurs in Lower Rio Grande Valley. On *Ulmus crassifolia* in Brownsville, Texas, May 1, 1895. Coll. Towns.

Peculiar to Rio Grande Valley. *C. furfurus* Fitch. is known in Massachusetts, New York, Illinois, Maryland, southern California.

This ends the list of species so far known from Mexico. It should be stated that *Lecanium verrucosum* and *Dactylopius calceolariæ* have been erroneously recorded from Mexico.

Professor Cockerell's paper on Mexican Coccidæ, in 1893 (Ann. & Mag. Nat. Hist. Ser. 6, Vol. XII, pp. 47–53), brought the list of species and varieties then known up to 30, his paper having added 12 species. The early additions to the list are shown in the following table adapted from Cockerell:

Species known from Mexico before Signoret's time, . . .	3
" added by Signoret (1873–75), ...	2
" " Comstock (1882–83), ...	3
" " Riley and Howard (1890)	2
" found by Dugés (up to 1893)	8
Total up to 1893, ...	18

In 1893, Cockerell found, on a trip through Mexico, 12 additional species, bringing the list up to 30. Since then the number has been increased by the writer, who found 19 additional species in 1894; 8 further additional in 1895; and 16 still further additional in 1896. In addition to these, Mr. Alexander Craw has found, up to 1897, in the course of his horticultural quarantine work at San Francisco, 7 more species, thus bringing the total up to 80 in all with the close of the year 1896. Therefore, in three years (1894, 1895 and 1896) the list of Mexican Coccidæ has been increased 50 species, and that during only a few weeks each year, probably not exceeding three months altogether, during which time much other work was also attended to. This indicates the surprising results to be obtained in collecting and investigating scale-insects in Mexico, Central America, and the West Indies, as well as South America, which is still less known in this respect. The writer is at present engaged in collecting further material in Mexico, and has a considerable number of species already which are doubtless additional to this list, but it will be some time before they can be worked up.

NEW SAWFLIES (TENTHREDININÆ) WITH DESCRIPTIONS OF LARVÆ.

BY HARRISON G. DYAR, PH.D.

Siobla excavata *Norton.*

Antennæ short and thick, a little thickened before apex; posterior tibiæ not reaching apex of abdomen; eyes reaching almost to base of mandibles; labrum round, pointed; lanceolate cell with oblique cross

nervure; under wing with one middle cell or none. Black, coarsely granular and with a fine golden yellow pubescence. Head black, clypeus and labrum bright yellow, two basal joints of antennæ orange yellow, palpi pale. Thorax black, posterior edges of prothorax, cenchri, trochanters, basal two thirds of all tibiæ and apex of anterior femora yellow; tegulæ orange yellow; apex of tibiæ and tarsi light brown. Abdomen black, basal plates yellow, first segment brown centrally, each segment with a narrow posterior yellow line, the terminal segment half yellow; venter black. Wings faintly yellowish smoky, veins black, costa and stigma brown, the latter yellow at base; a black dot in the second submarginal cell. Length of male 10 mm., female 11 mm. *S. robusta* Kirby seems to be the same species. Larva characterized Can. Ent., XXVII, 339 as "5c."

Stage I.—Head .35 mm., brown-black, shiny; skin dark.

Stage II.—Head .53 mm., black, slightly pruinose. Body dull gray, scarcely darker dorsally except from the food showing by transparency; thoracic feet black; subventral region white; no spots.

Stage IV.—Head .9 mm., dark gray, body pruinose gray, brighter subventrally, annulate. No marks. Length 10 mm.

Stage V.—Head black except around the mouth, covered with white bloom; width 1.3 mm. Dorsal area faintly grayish, lateral black spots distinct, two on each segment; a series of small black spots subventrally along the bases of the feet, three on each segment. Subventral region yellowish, black points present; a white bloom.

Stage VI.—Head black, pale around the mouth; width 1.6 mm. Body as in the mature larva but the gray less evident, marks all smaller and fainter. A thick white bloom gradually appears.

Stage VII.—Head shining black with a faint white bloom; antennæ short, pointed; width 2.0 to 2.2 mm. Thoracic feet large, slender, divergent, abdominal ones small, present on joints 6 to 13. Segments 6-annulate with minute black points on the second and fourth annulets, a few others on the third annulet, stigmatal and subventral folds. Body pruinose leaden gray, a thin white bloom on a sordid greenish leaden ground; a series of diffuse, quadrate, black patches laterally, two on each segment between annulets 1–2 and 4–5. Upper subventral fold faintly yellowish, obscured by the bloom; lower fold black, forming a nearly continuous band. Subventral region white; feet and venter whitish; thoracic feet largely black. Solitary feeders, do not curl.

Stage VIII. (ultimate)—Head leaden black, but over the clypeus and below antennæ whitish; width 2.2 mm. Body annulate, shining, leaden

black throughout, no bloom; a series of large lateral patches, one on a segment, on joints 2 and 5–12 covering the spiracles, creamy yellow. These patches are as broad as the width of annulet 2 and posterior half of annulet 1. Thoracic feet leaden, clear at the joints; abdominal feet clear at tip. On attaining this stage the larvæ enter the earth.

Found commonly on the button bush (*Cephalanthus occidentalis*) around New York City early in June, a large and striking larva, often completely defoliating the plants of their young leaves. They all disappear by the middle of June and the flies do not appear till the following spring.

Macrophya trisyllaba *Say.*

Found by Mrs. Slosson at Franconia N. H., feeding on the elder (*Sambucus racemosa*).

Upper half of head black, lower white. Body segments 7-annulate with distinct white points on the second and fourth annulets. Dorsum to the spiracles black, mottled with sordid white principally in a festooned narrow subdorsal line and straight dorsal one. Below the spiracular line whitish with several small black spots on each segment and one on the base of the foot. Anal plate black. Thoracic feet pale with a mark at the base; abdominal feet on joints 6 to 13.

Ultimate stage.—Smooth, without points, shining waxy, the black coloration as before but paler, dotted with whitish and the creases of the annulets pale, hence the general appearance is paler than before. Head pale, eye black; a dusky shade over the vertex. The larvæ enter the ground to hibernate.

Mrs. Slosson sent me a few of these larvæ in September; the fly emerged the following spring:

Tenthredo atroviolacea *Norton*, var. **peratra**, var. nov.

Agreeing exactly with the description of *Tenthredopsis atroviolacea*, Norton, except that there is no white spot on the posterior coxæ and the third joint of antennæ is one and one-half times as long as the fourth. This is doubtless a variety of *T. atroviolacea*. The fly is entirely black, head, thorax and legs dull with large punctures, wings rather opaque violaceous, the venation of the posteriors as described for the male of *T. atroviolacea*. One male, bred from larva.

The larva is a very curious one. For a Tenthridinid remarkably specialized, having reached the stage of some Noctuid Lepidoptera (*e. g.*, *Pseudoglossa lubricalis* or *Cucullia artemisiæ*).

Looks a little flattened, but thick and robust. Feet on joints 6 to 13. Head round, dull black; width 1.4 mm. Body segments 7-annulate, the whole body soft dark gray, the ground color uniform. A

series of short thick papillæ, one on each annulet in subdorsal and lateral even regular rows, and other smaller ones scattered subventrally. First row (subdorsal), which is the shorter, has the papilla on annulet 1 orange, 2–4 black, 5–6 orange, 7th black; second row (lateral) which is larger, has 1st to 4th orange, 5th to seventh black; two behind the spiracle and two subventrally posteriorly pale orange; two groups of six to eight very small ones on the upper and lower subventral folds whitish. Sides with a number of small black spots. On thorax there are less of the papillæ, but the alternation in color is similar. Anal plate not differentiated.

Ultimate stage.—Smooth, very shiny, entirely dark slaty blue black, papillæ indicated by very small concolorous points. Thoracic feet pale. Enters the earth at once to form a moderately firm hibernating cell.

Sent me by Mrs. Slosson from Franconia, N. H., feeding on the elder.

Mogerus caryicolus, sp. nov.

Lanceolate cell petiolate, under wings without middle cells, but a distinct marginal vein in the male, none in the female; eyes rather distant from base of mandibles. Shining black, abdomen largely whitish.

Male.—Head black, clypeus emarginate and with the palpi white. Thorax black, posterior edge of prothorax, tegulæ, cenchri and all the sutures on the sides and below white; coxæ lined with black and white; legs luteous brown, base of tibiæ slightly marked with black, tarsi dusky. Basal plates of abdomen and extreme base of first segment black, the rest luteous above, sordid white on the sides, the tips of the segments faintly marked with subapical black lines; spiracles showing as black dots. Venter of abdomen darker, each segment broadly banded with black at the base, extending part way up the sides. Veins dark brown, stigma and costa pale luteous, shaded with brown at the margins. Wings clear.

Female.—Black above, clypeus white with brown tip, palpi pale. Thorax black, the middle and side lobes of mesothorax brown with a black central streak in each; posterior half of prothorax and tegulæ white; upper half of pleura brown; coxæ and trochanters marked with black and white. Abdomen black dorsally, sides and venter sordid greenish white, the posterior edges of all the segments with a fine white line; ovipositor sheaths blackish; spiracles black dotted. Length 6.5 mm.

There is some variation in color. Another female has the brown on thorax largely replaced by black, but the sutures on the sides distinctly marked in white as in the male. The abdomen is narrowly black banded below and the segments above are black only on the anterior portion. Costa and stigma pale.

I have placed this species in *Mogerus* on the characters of the male. The female is a *Blennocampa*.

Larva.—Head 1 mm., shining greenish white, eye in a black spot. Body green, faintly 5-annulate, with short Y-spines, all whitish, uniform.

Feet on joints 6–13. Thoracic feet colorless; dorsal vessel dark green, no marks. The spines are arranged three on second annulet, the upper one forked, the two lower simple and short; one small point low down on third annulet; three on fourth annulet, the two upper forked; two on each division of subventral fold, all simple, short.

Last stage.—No change. Head 1.3 mm. The head and thoracic feet seem a little greener than before.

Ultimate stage.—Smooth, waxy, scarcely shining, all pale whitish green, dorsal vessel dark. Segments indistinctly 3-annulate. Head concolorous with body, eye black; width 1.3 mm. Length 11 mm. The Y-spines are entirely absent.

Found on young hickory leaves at Fort Lee, N. J., during the last of May. Single brooded. This is doubtless the larva briefly described in Dr. Packard's 5th Report U. S. Entomological Commission, page 317, as "Selandria sp."

Harpiphorus maculatus *Norton.*

A specimen with three submarginal cells on one side and four on the other was bred from a larva on *Potentilla Canadensis* at Fort Lee, N. J. Head with a tiny brown spot behind the eye and dot at back of occiput on vertex. In ultimate stage head whitish, with a leaden patch on vertex. (See Can. Ent., XXVIII, 236.) The larva was intermediate between *H. maculatus* and *Monostegia ignota* in having but a trace of black spots on the head, and the imago was also intermediate in the number of submarginal cells.

Variety **coryli**, var. nov.

This larva is single brooded, disappearing before the middle of June. Found not uncommonly on the hazel at Plattsburg, N. Y., and VanCortlandt Park, New York City, in some cases rather destructive to the plants. I suppose this larva to represent a distinct species and referred to the larva as "5F" in Can. Ent., XXVII, 339. It differs in what seem good specific characters from the larva of *H. maculatus*, yet I do not find any differential points between the flies.

Solitary, usually out straight, sometimes curled, sitting on the under side of the leaf. Head faintly testaceous, a diffuse leaden black patch on the vertex behind; eye in a black spot; width 1.2 mm. The black spot reaches well down the side of the head, but the whole face is pale; a trace of white bloom. Thorax a little enlarged, abdomen scarcely tapering, slightly smaller posteriorly. Dorsum gray to spiracles, uniform or centrally dorsally on abdomen nearly white; sub-

ventral region white; a gentle white bloom; feet colorless. Segments 6-annulate. Joint 2 and the anal flap white. No points on the body and no spots.

Ultimate stage.—Head pale, pale silvery gray over the vertex. Body neatly 6-annulate, shining, dorsum pale greenish, silver gray ending above the tracheal line, brownish on joints 12–13; subventral region and legs pale, waxy greenish. Folds shaded with tarry brown. Spiracles dark.

Pontania robusta *Marlatt.*

No gall, but a portion of the leaf simply folded over. The egg is deposited under the lower epidermis near the edge, not far from the petiole. The larva eats little patches of the parenchyma on the under side scattering three-fourths of the way to the apex, apparently while the leaf is young; these patches are slightly swollen, discolored, pale, and as a result the outer fourth of the leaf folds back, neatly touching the surface, forming a hollow in which the larva lives. Finally the larva eats the whole leaf, emerging from its house and eating the apex of the leaf to return to the house again after feeding. The leaf is not rolled at all, simply folded. Fresh eggs were found May 9th. At that time the young leaf was neatly folded back though not fully grown. On expanding the folded part it was seen to be slightly larger than normal, forming a lobe on the leaf. The egg was situated under the lower epidermis, elliptical, white, .4 x .8 mm.

Stage I.—Head .35 mm. wide; all whitish translucent, the food showing by transparency. Head shining, body less so, the segments indistinctly 3-annulate; setæ fine, white, apparently a row on each annulet. Anal prongs colorless. Thoracic feet spreading. Length 1.5 mm.

Stage II.—Head .5 mm., pale brown, eye black, mouth brown. Body slender, colorless, translucent; segments irregularly 3-annulate, the first annulet flat, not bulging. Setæ whitish, very obscure. Anal segment somewhat swollen, prongs short. Feet on joints 6–11, 13.

Stage III.—Width of head .7 mm. As in the last stage. The apex of the leaf is not eaten, the larva still feeding on the parenchyma in a patch around the anterior edge of its house.

Stage IV.—Head 1 mm. The same. One was observed to emerge at the posterior end of the house near the petiole.

Stage V.—Head very pale brown, dotted, shining, eye narrowly black, jaws large, black, width 1.3 mm. Body shining, translucent,

slightly yellowish tinged with green, principally from the food. Segments 4-annulate, the fourth small, three rows of fine but rather long, colorless setæ on the first three annulets. Thoracic feet rather large, colorless; abdominal small, on joints 6–11, 13, colorless; short, blunt anal prongs, also colorless. No marks and the head is pale brown. The larva eats the whole leaf when it emerges, sitting on the edge, the body curled down a little on one side of the leaf. The larvæ will rasp with their prongs when in the houses if disturbed. At the end of the stage the larvæ enter the ground. Body all pale emerald green, the head brown. Anal prongs rudimentary, brownish, situated on the edge of the anal flap.

Found on the small leaved poplar (*Populus tremuloides*) at Fort Lee, N. J. I have also seen the characteristic houses on the poplar near New York City and at Jefferson, N. H. There is only one brood a year, the larvæ disappearing at the end of May or a little later. The houses remain on the tree much longer. Cocoons formed on the ground. The fly corresponds with Mr. Marlatt's description of the female; the male is not like his description.

Pontania pallicornis *Norton.*

With the habits of *P. robusta* but living on the willow. The smooth leaves are closely folded over, the house long on the narrow leaf, 25 to 40 mm., about one-fourth of the leaf turned over, so that the outer edge just reaches the midrib. The folded part at the angle where it is bent is slightly swollen and yellowish, caused by little scattered patches eaten from the under side.

Egg slits under the lower epidermis half way between the midrib and margin.

Stage I.—Head brownish, not black, width 2 mm. Body as in the next stage, small, colorless, whitish. The larva was seen sitting by the egg slit, no food in the alimentary canal and no marks of eating, yet a good folded house, the leaf swollen between the veins. This was a very young leaf.

Stage II.—Head shining blackish brown, nearly black; eye black; width, .3 mm. Body colorless, the food green by transparency.

Stage III.—Head brownish black, paler than before; width .4 mm. Body the same, but the anal end appears black from the contained frass, intensified by a black subdorsal patch which is now present. Prongs short, blunt, black.

Stage IV.—Head pale, dotted with brown over the vertex, a dark

brown trilobate patch on the clypeus, eye black; width .6 mm. Segments indistinctly annulate, rather coarsely two-ridged, showing on the subventral outline; on thorax only simply ridged; tubercles concolorous, setæ fine and pale. Subdorsal anal black patches preceded by a narrow transverse band; anal point black; body greenish.

Stage V.—Head pale brown, darker on the clypeus, eye black; width 1.2 mm. Thoracic feet rather large, colorless, abdominal ones moderate on joints 6–11, 13. Body transparent, green from food and slightly so from blood. Anal flap distinct; rounded, marked with a deep black subdorsal patch on each side. Points rudimentary, dark; tracheæ evident. The larva comes out the apex of the house and eats the whole leaf. Single brooded; the larvæ can be found till the middle of June. (Cocoons formed on the ground.) On the willow at Van Cortlandt Park, N. Y.

Pontania gracilis *Marlatt.*

Galls on the willow at Van Cortlandt Park, N. Y. City and also sent me by Dr. Lintner in numbers from Gouveneur, N. Y., on *Salix petiolata.*

Gall as described by Marlatt (U. S. Dept. Agr. Div. Ent., Tech. Ser. 3, p. 39), but not quite so large. Nearly spherical or a little elongated in the direction of the leaf, nearly evenly divided by the leaf, projecting half its width beyond the edge; single or rarely two on a leaf, situated near the petiole to one side of the midrib. Smooth, green, a few corky dots, very little red blush if any. Size 7 to 10 mm. in diameter. The shell is thin, containing a large hollow.

Stage III.—Head .5 mm., lower half white, vertex above black, eye smoky blackish, jaws brown. Body opaquish white, rather densely finely pilose; thoracic feet quite large, abdominal ones on joint 6 to 11 and 13, small. Anal end obliquely sloping, dusky shaded dorsally on joint 13. No prongs. The larva can move the body violently up and down.

Stage IV.—Head paler, dotted above; width .7 mm. Anal end round pointed from dorsal view with a few tiny dark specks. Body all opaquish white.

Stage V.—Head pale brown, sometimes with a blackish shade in clypeus and up from eye, eye black; width .85 to 1 mm. Body whitish colorless, segments 3-annulate with slightly watery shiny tubercles on each, not distinctly pilose, the setæ fine. A single, small, pointed, blackish minute tip to anal plate. The anal end is round pointed with a few dusky dots above.

When the galls are withered the larvæ emerge, colored uniformly whitish ash gray, and bore in soft wood to form their rather frail cocoons. There is but one brood in the year.

Pontania hyalina *Norton.*

Gall.—Mr. Marlatt gives a figure and description of the mature gall (Tech. ser. 3, U. S. Dept. Agr., Pl. Fig. 2, p. 37) in a place where the galls were numerous. As the eggs are laid only in the very young leaves and the species is polygoneutic, this necessarily happens in the case of the later broods, where only the few growing shoots are available for oviposition. Earlier in the season the galls are more scattered, usually but one on a leaf, generally remote from the petiole, but sometimes near or adjoining it. Situated between the midrib and the margin, rarely reaching the edge, never exceeding it. When the young leaf is just unrolled and still reddish, the egg is deposited by an elliptical cut below the epidermis on the under side, an inconspicuous puncture. As the leaf grows, the egg area enlarges by natural growth of the leaf, becoming also slightly thickened and surrounded by a bright crimson ring. This red ring later thickens faster than the central portion, producing the irregular shape of the mature gall. This is elliptical with irregular surface, especially below, evenly divided by the leaf, usually green or pinkish below, reddish or even brown and withered above, often black spotted; 8x5x6 mm. Some are very irregular below, grooved on one or both sides where crossed by the veinlets, thick, succulent and watery rather than fleshy, cavity small, elliptical, green inside. At maturity they are hollowed to a shell. The full grown larva eats a hole in the gall and escapes, leaving the empty gall on the tree where it may become the hiding place for other insects. A larva of Ichthyura was found in one. The galls are found on the trees at all stages at once, there being no regularity in the succession of broods. There appear to be five larval stages.

Egg.—Irregularly elliptical, smaller at one end, shining translucent white; .6 x .2 mm. Found in a gall which had attained the size of 4.5 x 2 mm. and consisted of an annular swelling with a central hole extending through the leaf. The egg was at one one side of the hole.

Stage II.—Head round, shining, dusky blackish; width .35 mm. Body uniform bright emerald green, segments 3-annulate, minutely setiferous; anal end slightly tapering, rounded. Thoracic feet large, abdominal ones very small, rudimentary, present on joints 6 to 11; all emerald green like the body.

Stage V.—Head leaden blackish, sutures of clypeus broadly pale. eye black; width .95 mm. Body yellowish green, darker from the shade of the alimentary canal, ill-defined wrinkly 3-annulate, minutely setiferous, no distinct tubercles. Anal end bluntly rounded, brown dotted above. Feet moderate, on joints 6 to 11; tracheal line evident.

At maturity the larva eats a hole in the gall, through which it pushes out the frass for some time before it is ready to leave the gall. Sometimes more than one hole is eaten or even an adjoining part of the leaf.

Cocoon.—Oval, brown, dense and opaque, sometimes formed between leaves on the tree or in a deserted gall.

Found on a large smooth-leaved willow tree at Bellport, Long Island.

Strongylogaster abnormis *Provancher.*

Larvæ found on knot weed (*Polygonum lapathifolium*) in New York City differed from those which I have previously recorded on *Rumex* (Trans. Am. Ent. Soc. XXII, 311), as follows: Head whitish with a light gray patch before the apex of each lobe; a brown patch in clypeus; a very slight bloom. Subventral folds slightly angulated and with the white points suggesting somewhat the appearance of *S. pinguis*, especially as the larvæ when occasionally sitting on the upper surface of the leaf may be somewhat sinuate. Anal segment green, concolorous with the rest.

Strongylogaster pinguis *Norton.*

Egg.—Under the upper epidermis in an irregularly elliptical area 1.7 x 1.4 mm., transparent, overlaid by the reticulations of the epidermal cells. Before hatching the larva swells up somewhat and a ring of air forms around it, appearing like a white margin.

The newly hatched larva has a width of head of about .3 mm., confirming my former observations, which I had doubted (Trans. Am. Ent. Soc., XXII, 308) and showing that there are probably seven stages instead of six. My descriptions, then, refer to stages I, II, IV–VII.

Found on black oak at Bellport, Long Island.

Acordulecera dorsalis *Say.*

The larvæ recorded in Can. Ent. XXVII, 340 as "6U" on hickory, proved to be not different from this species when raised to maturity. A number were found at Fort Lee, N. J., on pig nut hickory. I have also seen others in which the head was partly black and partly pale. The food plant was not the cause of the difference in color of the heads, as I have seen the black form also on the oak.

Lophyrus fabricii *Leach.*

Gregarius on pitch pine (*Pinus rigida*) at Bellport, Long Island, N. Y.

Stage before last.—Head blackish brown, shiny; width 1.5 mm. Body greenish white, a little shining, immaculate except for a faint, double, dusky suranal cloud; segments 6-annulate with minute points on the first, second and fourth. Thoracic feet black; abdominal ones present on joints 6 to 13.

Last stage.—Head round, higher than wide, smooth, shining brown-black; eye blacker; width 2 mm. Body slightly greenish, white, opaque. A broad, regular, sub-dorsal gray shade line on joints 2–13, rarely a narrow fainter dorsal one. A row of square black spots above the stigmatal line resting on the tracheæ, broken and partially disconnected by the annulets, one spot on a segment, covering annulets 2 and 4 on joints 3–12; a large, geminate, sooty black suranal patch. Subventral region white without marks. Thoracic feet black, except at the joints; abdominal on joints 6–13. Rarely the subdorsal shade is faint. The lateral spots vary somewhat, those on the thorax the smallest. Segments 6-annulate, 1st, 2d and 4th with a transverse row of minute black points.

When disturbed the whole brood will elevate the thoracic parts simultaneously.

Ultimate stage.—Head sordid whitish, shaded with black on the vertex, eye black. Body dull grayish, subventer waxy yellowish, a double dorsal, a broad lateral inky black, smoky band, cut by the incisures. Thoracic feet faintly blackish, banded. Anal flap broadly inky.

Cocoon.—Elliptical, dense but thin, light brown, single.

Eleven females bred from a single brood of larvæ, vary in the number of joints of antennæ. Seven have 16 joints, three 17 and one is intermediate, being very indistinctly 17-jointed. The specimens correspond with the description of *L. pini-rigidæ* Norton, which I consider a synonym of *fabricii*.

Eriocampa juglandis *Fitch.*

Head large, full at the vertex, nearly colorless, shining, a little yellowish, covered with a thick white bloom; eye black, mouth brown. Body appears dark, greenish or blackish gray, but when denuded of wool it is colorless, though darkly shaded from the contents of the alimentary canal; coarsely and deeply 6-annulate. The subventral

fold has some mealy bloom; dorsum covered with long tufts of white down which is secreted slowly after each molt, in long, flattened masses, two dorsal, two subdorsal, three lateral, the posterior one lower; subdorsal tufts longer than the unpaired dorsal ones. The wool may become 5 mm. long and curls a little. Three stages observed with widths of head 1.1, 1.5 and 2.1 mm.

Ultimate Stage.—Head 2.1 mm. Perfectly smooth, uniform opaque yellowish white, head shining and a shade darker, eye black. Segments indistinctly transversely wrinkled. Body robust, thick, as high as wide; thorax very slightly enlarged.

Food-Plant.—Butternut. Found at Greenwood Lake, N. J.

Dr. Packard has confounded this species with *Monophadnus caryæ* Norton (5th Rept. U. S. Ent. Comm., 339). Fitch's butternut larvæ, on being bred, prove to belong to *Eriocampa*, and moreover they differ from the hickory larvæ of Norton in being blackish, while the latter are described as greenish beneath the wool.

NOTES ON VARIOUS SPECIES OF COLEOPTERA.

PLATE X.

By F. W. WEBSTER.

It has always appeared to me as a good plan to record the little, detached observations that are made by almost every observing entomologist. Taken individually, these are very often almost devoid of scientific value, but we all of us know how much light some point, of itself unimportant, will throw upon the problem of a life history, when we attempt to work this out, or construct it from the known facts at our disposal. It is as if a huge piece of chinaware were to be dashed into an infinite number of fragments, and these scattered broadcast over the land, and the attempt then made to bring these fragments together, and from them construct the piece anew. It would probably occur that many pieces would have to await the discovery of one, and again, a piece would fit fairly well into the wrong place, and the error could only be detected by the right fragment finally turning up and indicating its proper place.

Some of these notes have been, in the main, recorded elsewhere, but without illustration; and it seems to me to be a matter of mutual benefit to have, somewhere, as accurate illustrations of as many of our species as possible.

My two specimens of *Odontæus filicornis* Say, a male and a female, were taken nearly twenty years ago in a small tract of woods, in northern Illinois, under a decaying log, and I think in late November.

My only specimen of *Tyloderma variegatum* (Horn) was taken in early spring, April, I believe, in an ant hill, located in grass land. It was in hibernation, doubtless, as *T. foveolatum* Say, breeds in the stems of the Evening Primrose, *Œnothera biennis*, and *T. fragariæ*, in the crown of the Strawberry. My *T. variegatum* is from Illinois and collected many years ago.

Lina scripta Fab., has increased in some places and become quite destructive to young willow and poplar trees, being especially troublesome in nurseries, where such trees are being grown. It has been found to be a matter of considerable difficulty to manage these insects, especially the adults, with insecticides, and hand picking was found expensive. The present year has witnessed a very material decrease in numbers of not only adults but in a marked degree among the larvæ. The cause of this was pointed out to me by an observing nurseryman, who was not an entomologist, and who stated that there were several other bugs that were destroying the young. On examination, I found these several so called bugs to be the several stages of development of the Spined Soldier Bug, *Podisus spinosus* Dallas. I have since noticed the very young larvæ of the bug, stationed about an egg cluster of the beetle and destroying the young as fast as they hatched, and also attacking much larger larvæ while these were feeding on the leaves. This year, the trouble by the beetle has been so slight as to obviate the necessity of using preventive and remedial measures against them.

Not unfrequently we have statements to the effect that insect larvæ can be killed by shaking them from the plants, in excessively hot weather, especially if the plants are growing in sand. As showing the possibilities in this direction, though I have never had much faith in it, I will say that during the terribly hot weather which occurred in this country about the first of August, while walking along the pavement, I saw an adult *Phytonomus punctatus* Fab., attempt to pass over a portion of the pavement composed of thick glass for the purpose of lighting the room beneath. The beetle had hardly touched the glass before it began to exhibit signs of distress, and ere it had passed over an inch of the glassy space it turned frantically about, but before it could escape from its torture it rolled over and died. The temperature at the time was above 100° Fah., on the sunny side of the walls of the buildings, as indicated by thermometers.

Our Coccinellidæ do not appear to have many Hymenopterous parasites. I have, however, the dried skin of a nearly fullgrown larva of *Coccinella 9-notata* Hbst., probably, punctured by several round holes, showing that a parasite had developed within and several individuals made their escape. Just what the parasite is, aside from its being a Hymenopter, I cannot conjecture, but the holes for escape are unmistakable. This was found at Painesville, Ohio, August 5th.

Valgus canaliculatus Fab., Plate X, Fig. 5. This has come to be a fruit tree pest in southern Ohio, where the adult works very serious injuries by eating out the fruit buds of the pear and other fruits, in spring. I can find little regarding this habit in our literature, the single instance of this injury being recorded in Insect Life, Vol. 1, p. 53, where Mr. W. W. Meech, Vineland, N. J., stated that the adult ate out the young buds of the quince. The larvæ are known to develop in decaying wood, and my assistant, Mr. Mally, has found the beetles hibernating under decaying stumps.

Crioceris asparagi Linn., is making its way slowly but steadily west and southwest into Ohio, seemingly spreading more rapidly in these directions than to the southward. There is hardly a doubt but that it has made its way through New York, and along the south shore of Lake Erie, between the lake and the Alleghany Mountains, broadening out in its area in northwestern Pennsylvania and northeastern Ohio. It now covers the area laying east of a line drawn from a point located some distance west of Cleveland, to near the point where Ohio, Pennsylvania and West Virginia corner upon each other, and the Ohio river ceases to form the boundary line between the two States and passes into Pennsylvania at this place. Professor A. D. Selby, Botanist of the Ohio Experiment Station, informs me that an introduced plant, the Golden Hawk-weed, *Hieracium aurantiacum* L., a native of the Alpine regions of Europe, and introduced into this country prior to 1818, without much doubt, is now apparently spreading over Ohio from western Pennsylvania in almost exactly the same way.

In regard to *Oberea bimaculata* Oliv., I have only to again call attention to a point already published, unillustrated,* in regard to the astonishing amount of excreta evacuated by the larvæ during the space of 24 hours. The adult is shown, slightly magnified, in Plate X, Fig. 1, the larva, also magnified at the left. These larvæ burrow out the center of the twig as shown in Plate X, Fig. 2, cutting out round holes

* Insects of the Year in Ohio, F. M. Webster and C. W. Mally, Bull. 9, New Ser., U. S. Dept. Agriculture, Division of Entomology, p. 43.

through the walls thus left, for the ejectment of the excreta. This excrement is shown at the right of Fig. 1, also enlarged, and falls down on the outside in more or less broken and detached masses. The larva is, when nearly full grown, certainly less than an inch in length, and the amount of these ejectments were so astonishing that I determined to get some definite idea of the exact amount. We had at the same time two larvæ under observation in the Insectary, one working in apple, the other in Witch Hazel, *Hamamelis virginiana*, and the castings of each were carefully saved during a period of twenty-four hours. In both cases the weight, 0.05 gram, was the same; and placed end to end, the detached pieces measured twenty-four and three-eighths inches in the one case, the other being too much broken to measure correctly, but probably did not differ materially from the first. This is giving an amount of evacuation for each hour from 11.00 a. m. to 11.00 a. m., the period of time covered by the test, amounting to considerably more in length per hour than the length of the larva itself.

Cyllene picta Drury, has come to have a fondness for Osage orange, *Maclura aurantiaca*, hardly second to that for the Hickory. From a section of Osage orange fence post, one and one-half feet in length and four inches in diameter, placed in the insectary, there emerged between February 4th and April 14th, twenty-seven individual adults, the greatest number to appear in a single day being four, on February 24th. The beetle is shown in Fig. 3, Plate X, while the closely allied species, *C. robiniæ* Forst, which breeds in *Robinia pseudacacia* L., is shown in Fig. 4.

To our knowledge of *Cryptorhynchus lapathi* Gyll., Plate X, Fig. 6, I have little to add, beyond what was given in Journal New York Entomological Society, Vol. V, p. 30. My specimens survived for a time, the last one having died the latter part of November. There was no indication of oviposition, and probably this does not take place until spring, the insect developing to the adult, largely at least, by September. The adults kept, fed daily by puncturing the bark of willow with which they were provided, gouging out the cambium layer. They simply make a hole the size of the beak, and then by circling about excavate a circular cavity under the outer bark. In Europe the species attacks *Salix cinerea*, *S. alba*, *Populus*, *Betula*, *Alnus*, and *Rumex hydrolapathum*, from which last it probably derived its specific name.

EXPLANATION OF PLATE X.

Fig. 1. Adult, larva, and excreta of the latter, of *Oberea bimaculata* Oliv.

Fig. 2. Section of twig burrowed out by *O. bimaculata*, showing holes in the walls for ejectment of the excreta of the larva.

Fig. 3. *Cyllene picta* Drury.
Fig. 4. *Cyllene robiniæ* Forst.
Fig. 5. *Valgus canaliculatus* Fab.
Fig. 6. *Cryptorhynchus lapathi* Gyll.

All figures are slightly enlarged, and drawn from nature by Miss Lydia M. Hart, under supervision.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF APRIL 20, 1897.

Held at the American Museum of Natural History.

Vice-President Dr. Love in the chair. Thirteen members present.

The Publication Committee reported that a lecture, by Prof. L. A. Best, had been given and called attention to the next by Dr. E. G. Love, to be held April 24th.

A vote of thanks was given to Professor Lyman A. Best for his lecture given before the Society.

Mr. Joutel spoke on the breeding habits of beetles. He stated that each species always worked in the same way, and that some larvæ live only on the sap that they cause to flow from their wounding the trees and so renders it impossible to raise them in the breeding box. He exhibited a collection of fifty species mostly Longicorns bred by him, among which were *Callidium antennatum*, four species of *Elaphidion*, *Heterachthes 4-maculatus*, *Phyton pallidum*, *Stenosphenus notatus*, *Cyllene pictus*, *X. colonus*, two species of *Euderces*, *Leptura emarginata*, *L. lineola*, *Cryptophorus verrucosus*, *Saperda puncticollis*, *moesta*, *discoidea* and *obliqua*, *Elasmocerus terminatus* and *Ichnea laticollis*.

Dr. H. G. Dyar spoke on the morphology of the abdominal legs of the Megalopygidæ. He showed that there were two sets of legs of different functions, first, the ordinary legs with hooks on abdominal segments 3 to 6 and 10, used for prehension, and second, a series of paired soft pads on segments 2–7 used as sucking disks for adhering to smooth surfaces. The structure is peculiar and proves interesting as leading up to the creeping disks of the Eucleidæ where the prehensile legs have disappeared and the disk is formed by an extension of these short pads.

Mr. R. L. Ditmars read a paper entitled "Spiders," in which he gave a short history of their classification and structure, together with a sketch of their habits and uses. He called attention to their poison glands and fangs and compared them with those of the poisonous snakes. He illustrated their webs and explained their mode of construction.

MEETING OF MAY 4, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Ten members present.

A vote thanks was given to Dr. E. G. Love for his lecture on the "Study of Insects and their Transformations," delivered on April 24th.

Prof. D. S. Martin spoke on insect inclusions in fossil resins. He stated that many years ago he was an insect collector and collected in what is now the heart of the city. He said the subject of fossil insects had been well studied in Europe, and that the resins and insects had been found in many geological epochs. The resins being an excellent preserving medium, the insects were usually in good condition.

Fossil resins begin to appear in the Cretaceous but insects are not found in them; it is only when we come to the Eocene that insects begin to appear in the resins. The resin is a product of *Pinus succinefera*. He gave a history of the formation and its distribution and said that the African resins are of the latest Tertiary or Quaternary, and are found near the equator, that copal is not so hard as amber, and that Zanzibar is very rich in insects, but that they have not been well studied. The Zanzibar gum is found thirty to forty miles from the present beach, and is from a tree called *Tricolobium zanzibariense* which still grows in Zanzibar, and as the tree is a beach lover, it shows that the sea has receded that much.

Fossil resins, he said, are also found at the Magdallen River in South America.

Professor Martin exhibited many specimens, which included beetles, flies, ants, and bees, some like the Termes (white ants) were like those still found in the West Indies. After discussion, adjournment.

MEETING OF MAY 18, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Fourteen members present.

The Auditing Committee reported the accounts of the Treasurer as correct.

Dr. G. H. Horn presented four of his recent papers on Coleoptera to the Society.

Mr. Beutenmüller exhibited a number of hybrid moths, among which were crosses between *Actias luna* and *selene*, *P. ceanothi* and *cecropia*, *P. gloveri* and *cecropia*, *P. gloveri* and *columbia*. He also showed the cocoons of the hybrids which partook of the characters of both parents.

Dr. Dyar gave a few notes on his studies of the larvæ of sawflies, and called attention to their large thoracic and small abdominal feet, just the opposite to the Lepidoptera. He said they were subject to dipterous and hymenopterous parasites in the same proportion as the Lepidoptera but of different species. He also spoke of the setæ and their arrangement, but had not carried his studies to completion.

Mrs. A. T. Slosson gave a few notes on her winter collections at Biscayne Bay and Miami, Florida, and said that the flora and fauna were entirely different to those of Lake Worth.

Dr. Prime gave a graphic description of the environs of Miami, Florida, and mentioned that there was a solid foundation of coral covered by vegetable mould in the hollows, and that the solid land extends along the coast in a strip about four miles wide, the bay being on one side and the everglades on the other; insect life is confined to this narrow strip and to the rows of keys that extend along the coast three to five miles from the main land. He gave an amusing example of landscape gardening around the hotel, which was to cut down every tree, shrub and bush to the ground, leaving a barren clearing surrounded by virgin forests.

Mr. Beutenmüller informed the Society of the sudden death of Mr. Martin L. Linell.

"Martin Larson Linell was born at Gronby, Sweden, June 24, 1849, and died suddenly May 3, 1897, of heart failure. He matriculated at the University of Lund, Sweden, in 1870. His father intended to fit him for the ministry, but he left the University at the end of his third year for the railway mail service. In 1879 he married and came to America, being employed first in a chemical laboratory in Brooklyn and afterwards becoming Curator of the Brooklyn Entomological Society. In 1888 he was appointed an aid in the Department of Insects in the United States National Museum, which position he held at the time of his death. He was an invaluable museum worker, and during his nine years in Washington he worked over and arranged a very large share of the collection, and had recently began describing all of the new coleoptera." A bibliography of his published writings will be printed in the Entomological News.

MEETING of JUNE 21, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Ten members present.

The advisability of holding a field meeting on July 4th was discussed and left in the hands of the field committee for action.

Mr. Palm exhibited a number of moths from Arizona, amongst which was an unidentified cossid.

Mr. Munch showed a specimen of *Purpuricenus humeralis* var *axillaris* which he had bred.

MEETING OF OCTOBER 5, 1897.

Held at the American Museum of Natural History.

Vice-President Dr. Love in the chair. Eleven members present.

Mr. Beyer proposed for membership Mr. Charles Nushardt.

Mr. Joutel reported on the donations of insects for the auction sale by Mrs. Slosson, Messrs. Love, Seifert, Palm, Shoemaker, Ottolengui, Dyar, Cockerell, Doll, Münch, Joutel and Beutenmuller. A vote of thanks was given to all for their generous donations.

Prof. Cockerell communicated a note on the three species of *Xenoglossa*, found in New Mexico. He stated that these bees are commonly found in his locality and visit the flowers of *Cucurbita*, and that they are almost confined to this genus of flowers. *X. strenua* is described by him as *X. cucurbitarum*, but Mr. Fox stated that it agrees with Cresson's *Melissodes strenua*. It is, however, a true *Xenoglossa*.

Dr. Dyar spoke on the Pyromorphidæ found in New York, The family is a small one, allied to the Zygænidæ of Europe and more remotely to the Eucleidæ. There are three species in New York, *Harrisina americana*, *Acoloithus falsarius* and *Pyromorpha dimidiata*. The larva of the first is familiar, yet it needs further research, as there are two forms which may be different species. One form, described by Harris, is yellow with black warts; the other is banded with purple and has a white lateral line. The latter has not been bred recently. *Harrisina* is gregarious and feeds on the leaves of grape and woodbine. The larva supposed to be *Acoloithus*

is solitary, and feeds on grape, but rests on the withered portion of the leaf, with which its brown color harmonizes. A specimen of the larva of this species was shown. The larva of *Pyromorpha*, previously unknown, was discovered and bred last season. It is brown and feeds on dead leaves on the ground. The larvæ were bred on oak leaves, and some inflated specimens were shown.

Mr Beutenmuller said that he has found *Harrisina americana* on the leaves of Judas tree (*Cercis canadensis*) in Central Park, and found *Pyromorpha dimidiata* at Parkville, Long Island, amongst grass at the border of a dense woods, and that the insect was very local, being confined to only a short stretch of grass. The flight is short and soft, thus rendering it easy to capture.

Rev. Zabriskie showed *Phengodes plumosa* from Flatbush, Long Island, and *Phellopsis obcordata* from White Lake, N. Y., and also a borer, unknown to him, in the stems of currant.

Mr. Münch exhibited some beetles taken by him during the past season. Adjournment.

MEETING OF OCTOBER 16, 1897.

Held at the American Museum of Natural History.

Vice-President Dr. Love in the chair. Twelve members present.

Mr. Charles Nushardt was elected an active member. Mr. Beutenmuller proposed Mr. C. F. Hartman for active membership.

Mr. Beutenmuller gave some notes on the genus *Anthocharis*. He stated that this name had to be dropped in preference to the name *Euchloë*. This last name was proposed by Hübner (Verzeich. bek. Schmett., 1816) and the former by Boisduval (Spec. Gen., I, 1836, p. 556). He further stated that we had too many species in our list and that in long series of *sara* and the var. *reakirtii* which run from white to yellow, *stella* and *julia* could not be picked out. *Thoosa* Scudder is probably the same as *reakirtii* ♀ and the specimens in the Neumoegen collection from which descriptions were made by W. H. Edwards (Can. Ent., xi, p. 87) were without doubt the same as *reakirtii*, but the type in Scudder's collection must be examined to definitely settle this question. *Flora*, he thought was a small *reakirtii*, and *ausonides* certainly nothing more than a race of the European *ausonia*. Strecker so places the species in his catalogue. *Hyantis* is suspiciously close to *ausonides* and may prove to be the summer brood. All the specimens of *ausonides* in the Hy. Edwards' collection were taken from March to May and all the *hyantis* in July. *Rosa* is without much doubt a variety of *olympia*. *A. creusa*, *cethura*, *pima*, *lanceolata* and *genutia* are good species. *A. morrisonii* was not known to him.

It is our painful duty to herewith announce the death of Dr. George H. Horn, the well known and eminent coleopterist. He died at Philadelphia, Pa., November 25, 1897, in his fifty-eighth year of age.

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THE

NEW YORK ENTOMOLOGICAL SOCIETY.

Organized June 29, 1892.—Incorporated June 7, 1893.

The meetings of the Society are held on the first and third Tuesday of each month (except July and August) at 8 P. M., in the AMERICAN MUSEUM OF NATURAL HISTORY, 77th Street and Eighth Ave.

Annual dues for Active Members, $3.00.

Members of the Society will please remit their annual dues, payable in January, to C. F. GROTH, Treasurer, 139 East 40th Street, New York City.

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Vice-President, E. G. LOVE, ... 80 East 55th Street, New York.
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Seibelt, Otto,
Seifert, Dr. Otto,
Slosson, Mrs. A. T.,
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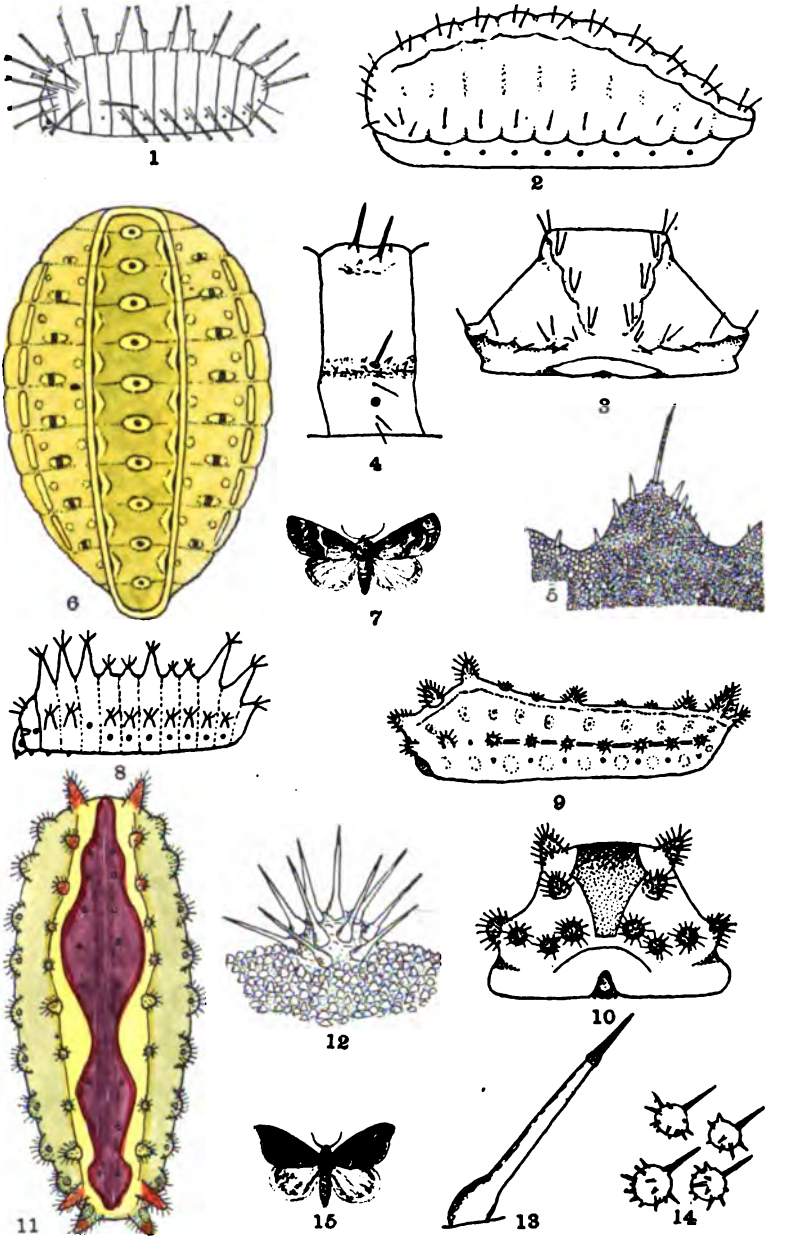
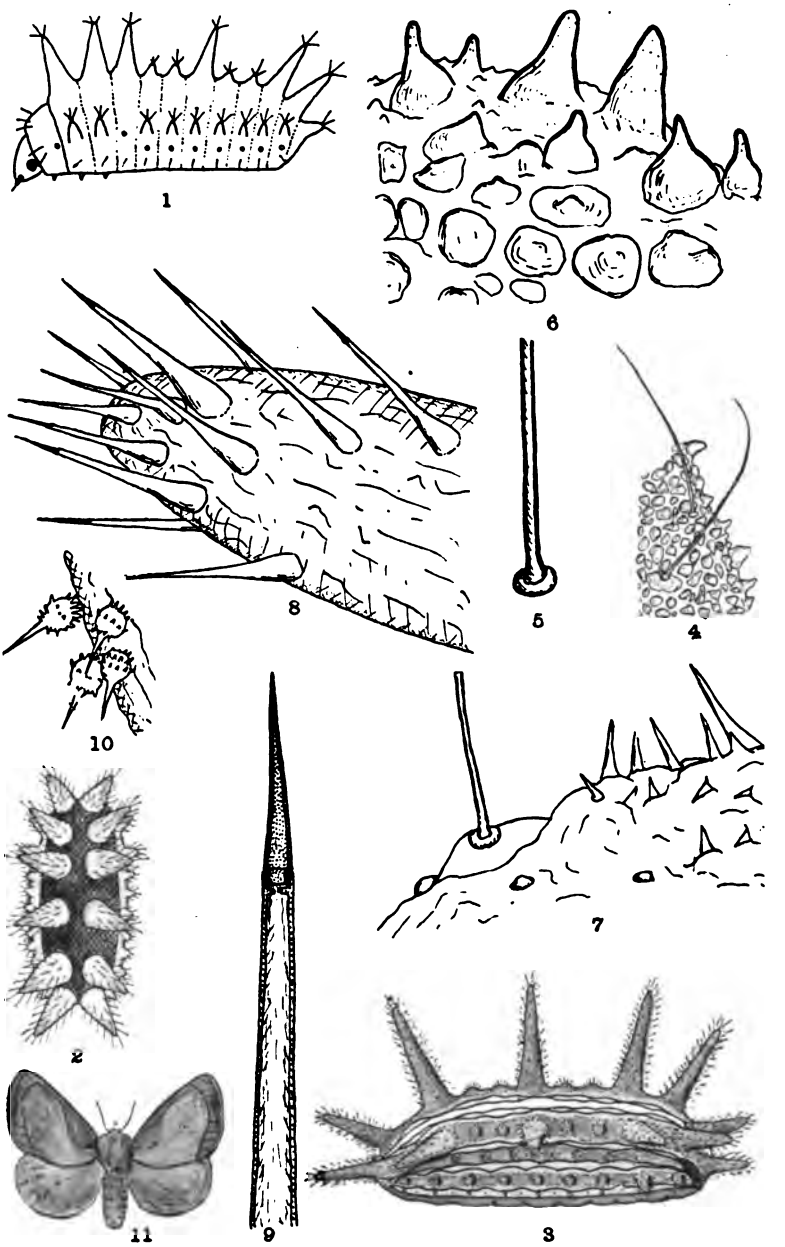


Life-Histories of Tortricidia fasciola and Adoneta spinuloides.



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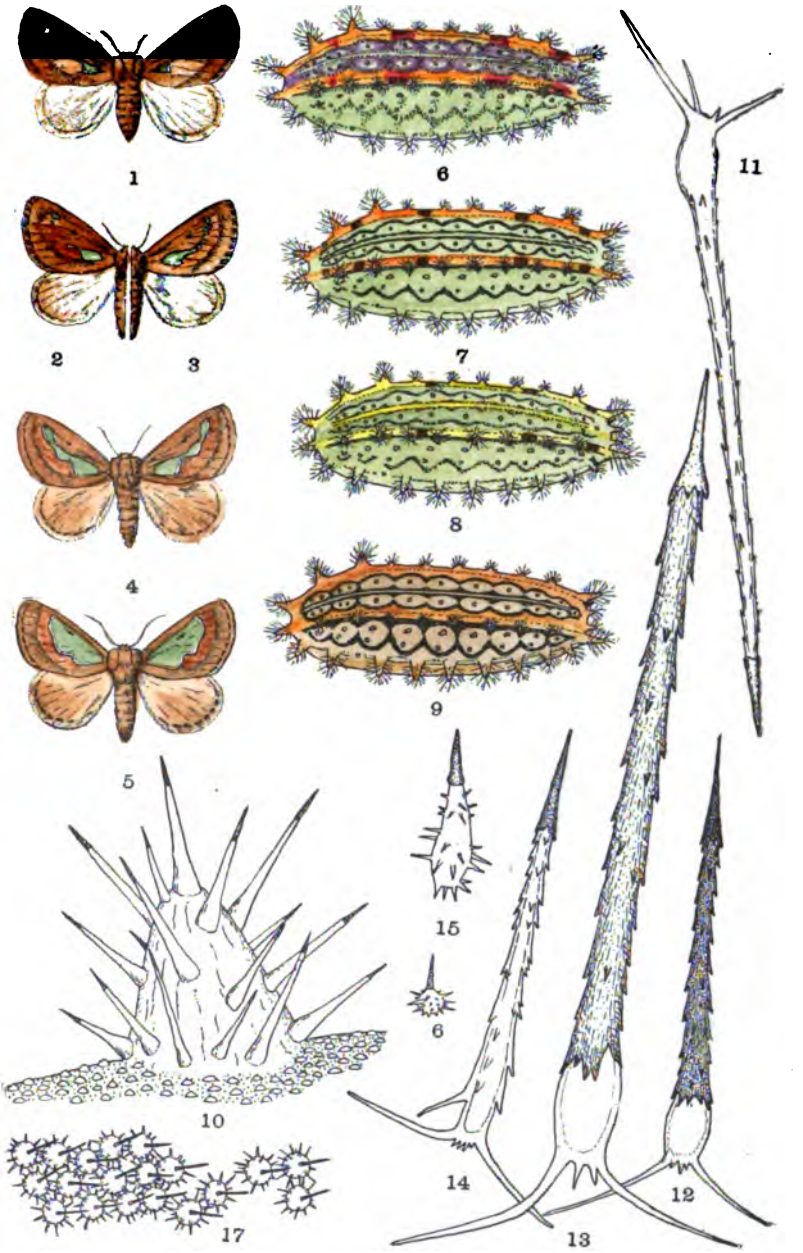
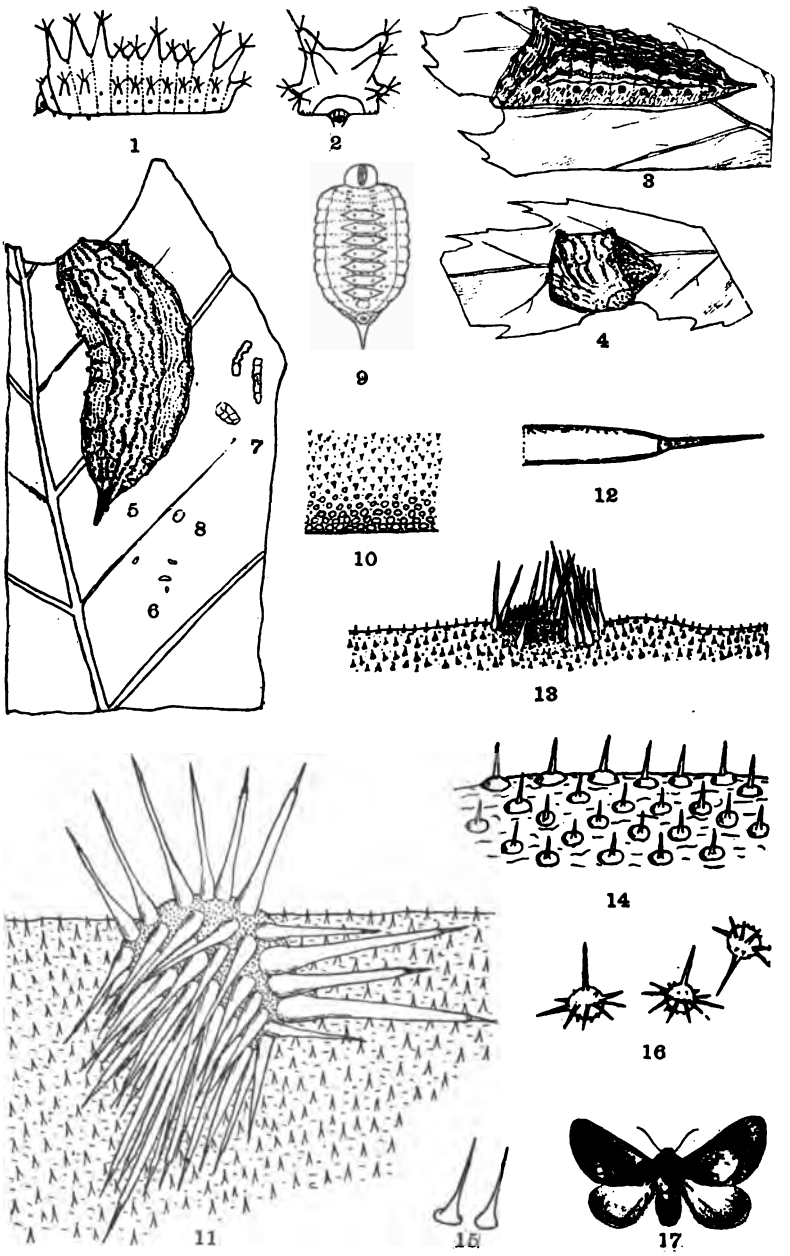
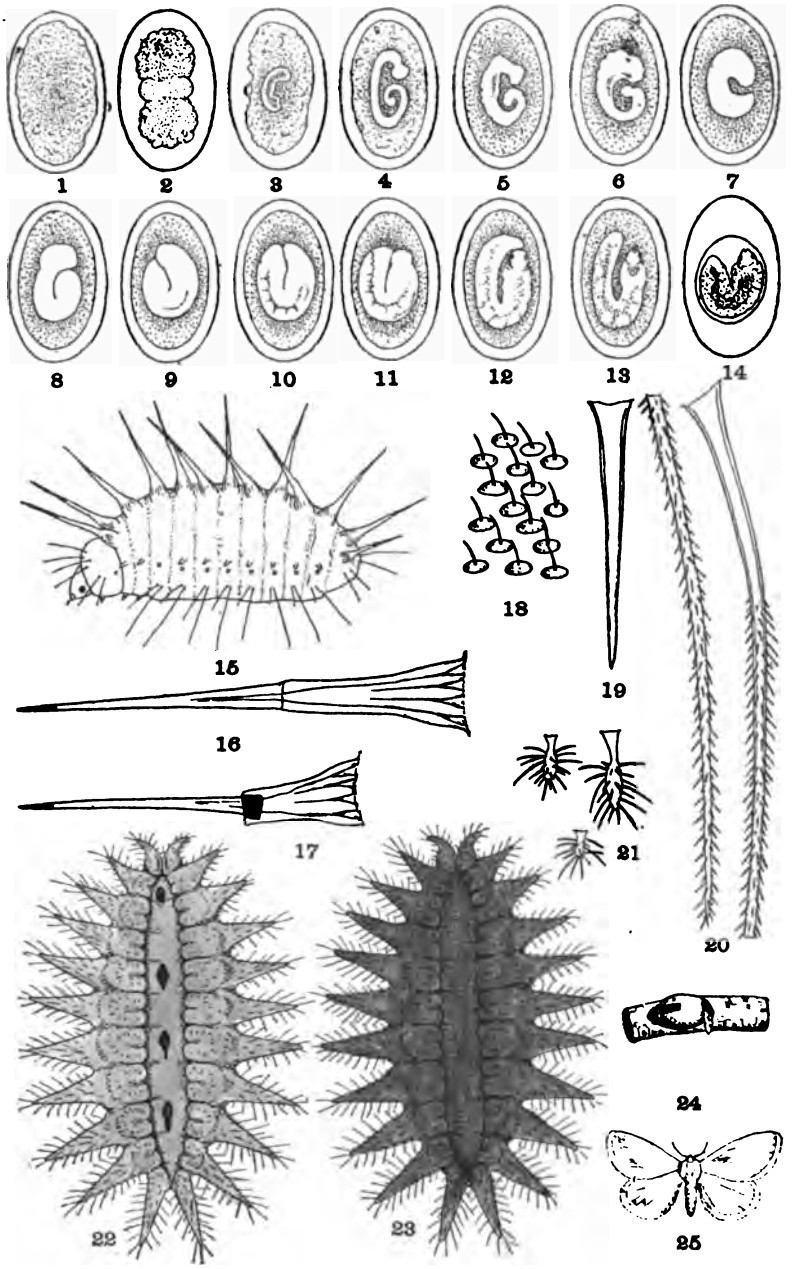


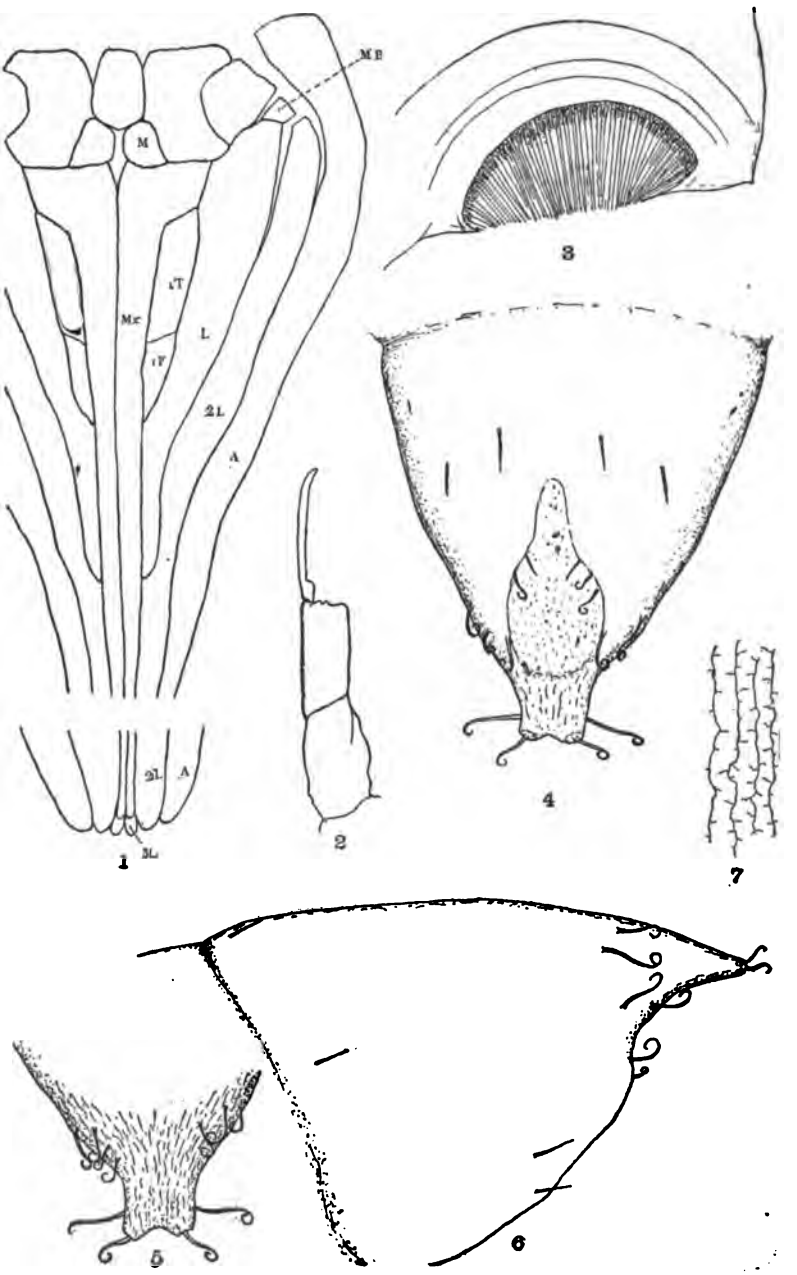
Life-History of Euclea delphinii.



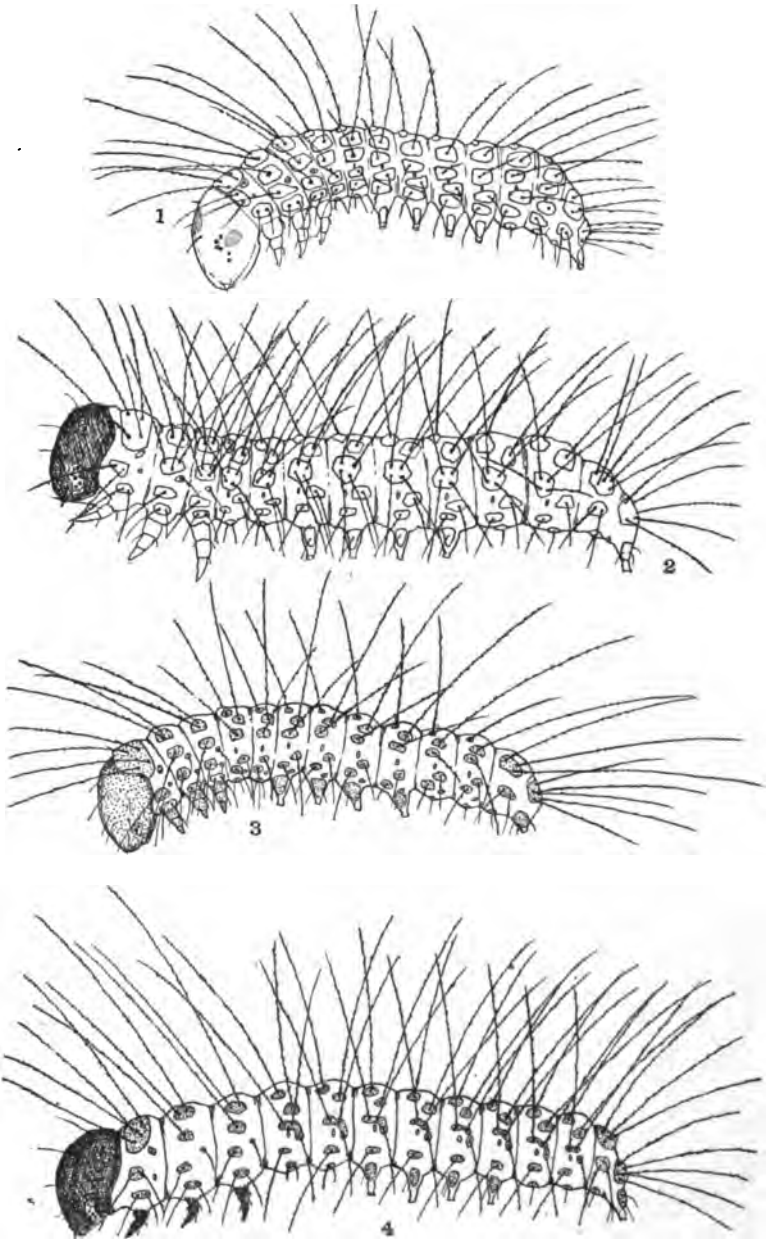
Life-History of Parasa chloris.



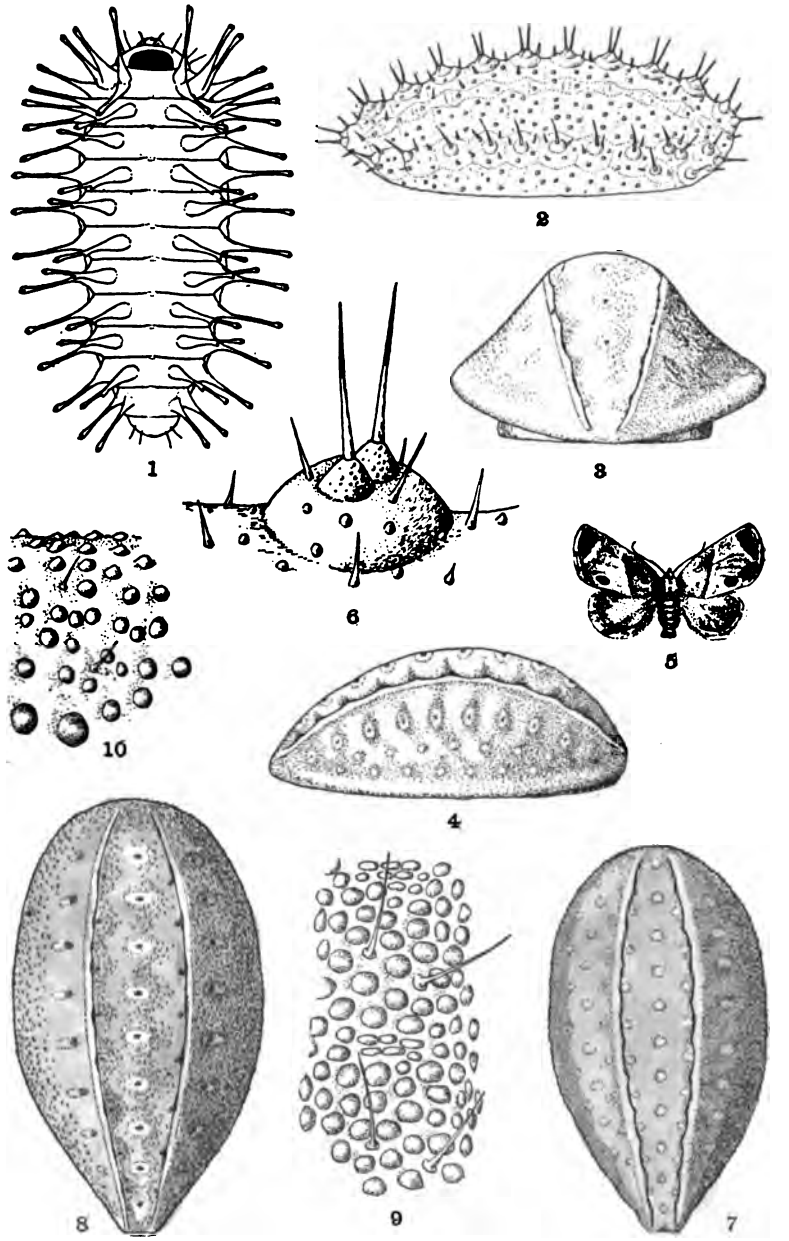
Early Stages of Calybia Slossoniæ.



Pupa of Oeta floridana.



Young Larvæ of Arctiidæ.



Life-History of Apoda biguttata.

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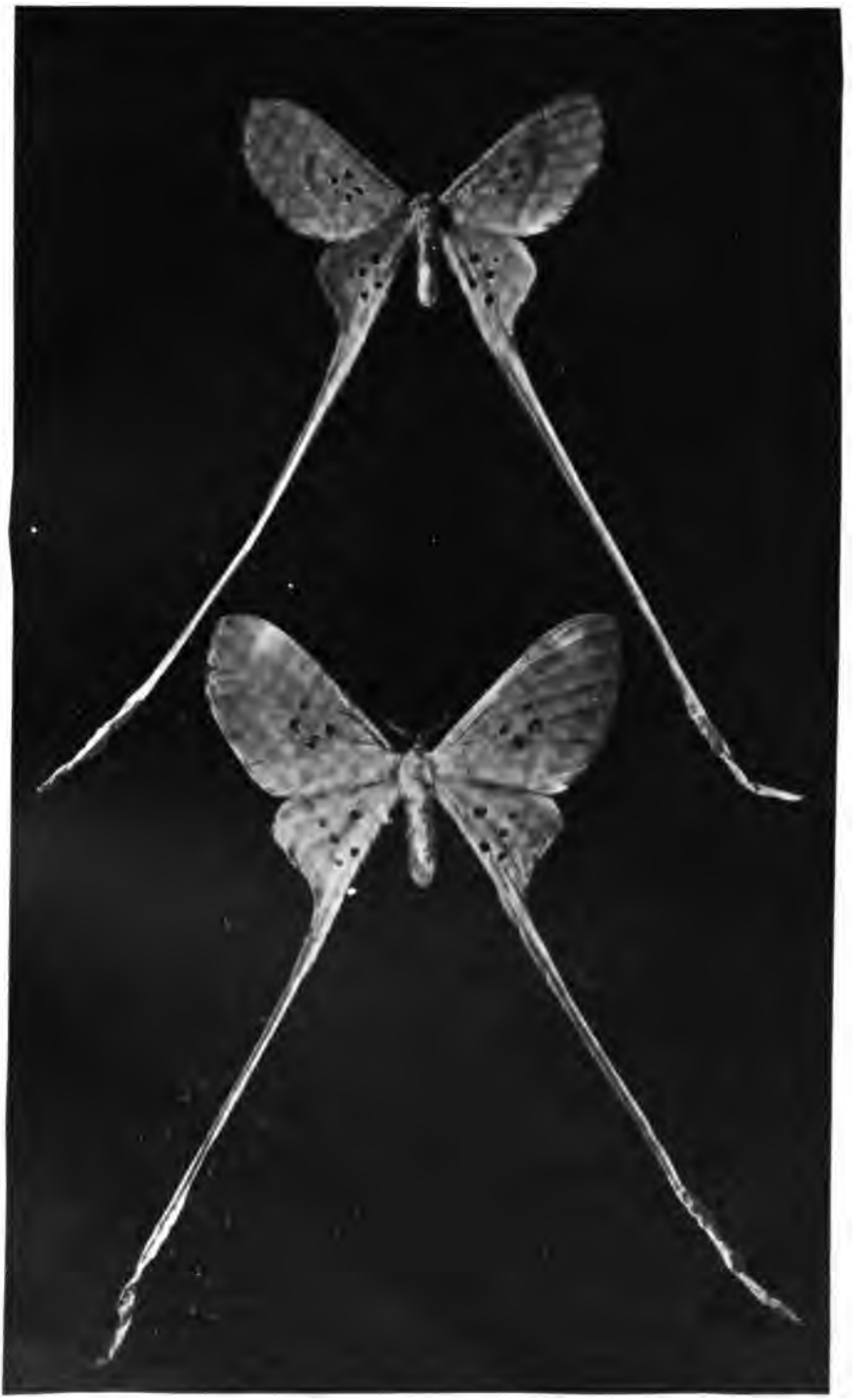
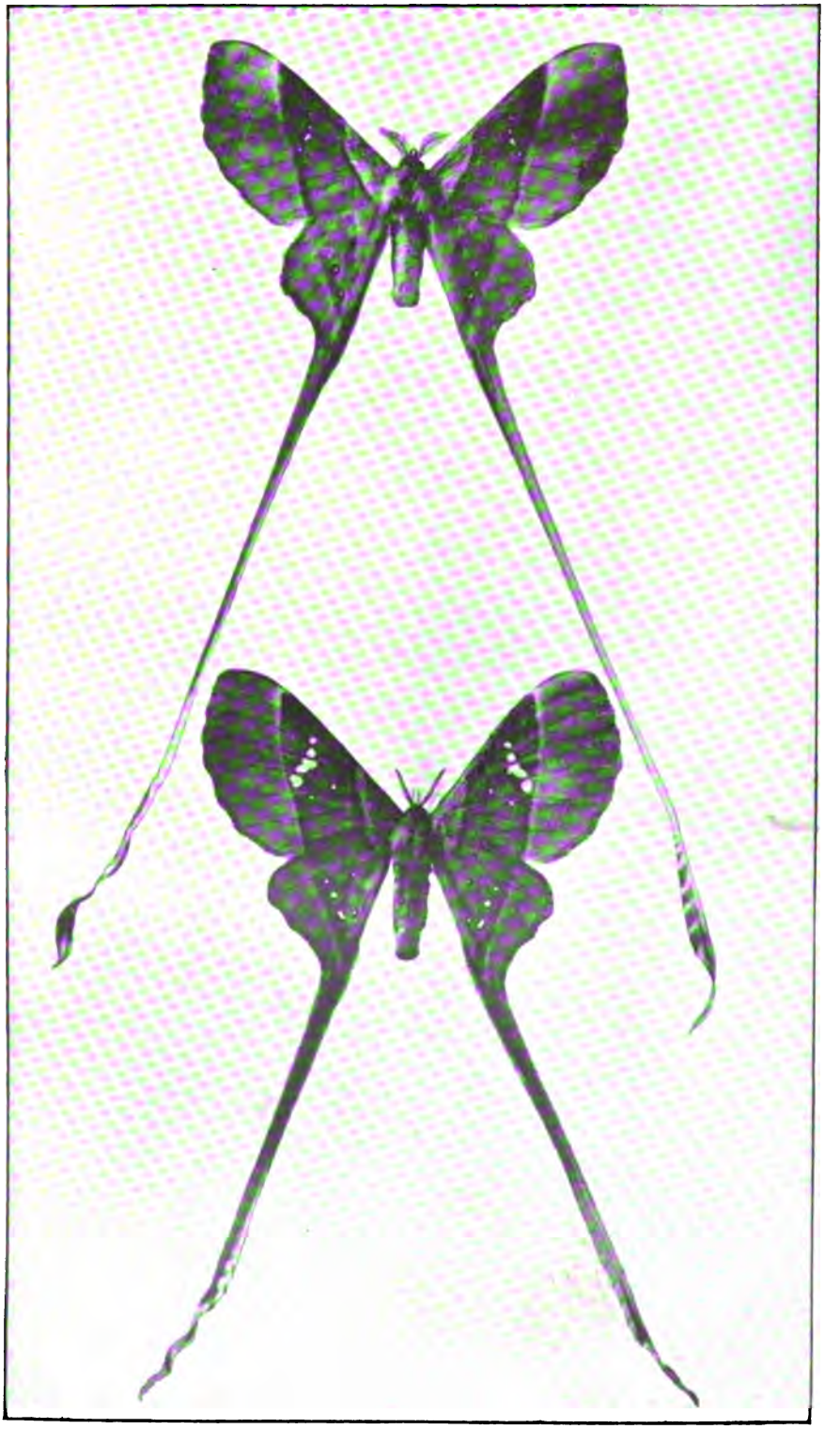
2.

Habits of Coleoptera.



Eudæmonia brachyura.



Eudæmonia argiphontes.